



Controls, Start-Up, Operation, Service, and Troubleshooting

SAFETY CONSIDERATIONS

Installing, starting up, and servicing this equipment can be hazardous due to system pressures, electrical components, and equipment location (roof, elevated structures, etc.). Only trained, qualified installers and service mechanics should install, start up, and service this equipment.

When working on this equipment, observe precautions in the literature, and on tags, stickers, and labels attached to the equipment, and any other safety precautions that apply. Follow all safety codes. Wear safety glasses and work gloves. Use care in handling, rigging, and setting this equipment, and in handling all electrical components.

⚠ WARNING

Electrical shock can cause personal injury and death. Shut off all power to this equipment during installation and service. There may be more than one disconnect switch. Tag all disconnect locations to alert others not to restore power until work is completed.

⚠ WARNING

This unit uses a microprocessor-based electronic control system. Do not use jumpers or other tools to short out components, or to bypass or otherwise depart from recommended procedures. Any short-to-ground of the control board or accompanying wiring may destroy the electronic modules or electrical components.

⚠ WARNING

To prevent potential damage to heat exchanger tubes always run fluid through heat exchangers when adding or removing refrigerant charge. Use appropriate brine solutions in cooler and condenser fluid loops to prevent the freezing of heat exchangers when the equipment is exposed to temperatures below 32 F (0° C).

DO NOT VENT refrigerant relief valves within a building. Outlet from relief valves must be vented outdoors in accordance with the latest edition of ANSI/ASHRAE (American National Standards Institute/American Society of Heating, Refrigeration and Air Conditioning Engineers) 15 (Safety Code for Mechanical Refrigeration). The accumulation of refrigerant in an enclosed space can displace oxygen and cause asphyxiation. Provide adequate ventilation in enclosed or low overhead areas. Inhalation of high concentrations of vapor is harmful and may cause heart irregularities, unconsciousness or death. Misuse can be fatal. Vapor is heavier than air and reduces the amount of oxygen available for breathing. Product causes eye and skin irritation. Decomposition products are hazardous.

⚠ WARNING

DO NOT attempt to unbrazed factory joints when servicing this equipment. Compressor oil is flammable and there is no way to detect how much oil may be in any of the refrigerant lines. Cut lines with a tubing cutter as required when performing service. Use a pan to catch any oil that may come out of the lines and as a gage for how much oil to add to system. DO NOT re-use compressor oil.

CONTENTS

	Page
SAFETY CONSIDERATIONS	1
GENERAL	2
INTRODUCTION	2
MAJOR SYSTEM COMPONENTS	3-10
General	3
Main Base Board (MBB)	3
Expansion Valve (EXV) Board	3
Compressor Expansion Board (CXB)	3
Scrolling Marquee Display	3
Energy Management Module (EMM)	3
Enable/Off/Remote Contact Switch	3
Emergency On/Off Switch	3
Reset Button	3
Board Address	3
Control Module Communication	3
Carrier Comfort Network Interface	3
OPERATING DATA	11-46
Sensors	11
• T1 — COOLER LEAVING FLUID SENSOR	
• T2 — COOLER ENTERING FLUID SENSOR	
• T3,T4 — SATURATED CONDENSING	
TEMPERATURE SENSORS	
• T5,T6 — COOLER SUCTION TEMPERATURE	
SENSORS	
• T7,T8 — COMPRESSOR SUCTION GAS	
TEMPERATURE SENSORS	
• T9 — OUTDOOR-AIR TEMPERATURE SENSOR	
• T10 — REMOTE SPACE TEMPERATURE SENSOR	
Thermostatic Expansion Valves (TXV)	15
Compressor Protection Control System	
(CPCS) or Control Relay (CR)	15
Compressor Current Protection Board	
(CGF) and Control Relay (CR)	15
Electronic Expansion Valve (EXV)	16
Energy Management Module	16
Capacity Control	16
• MINUTES LEFT FOR START	
• MINUTES OFF TIME	
• LOADING SEQUENCE	
• LEAD/LAG DETERMINATION	
• CAPACITY SEQUENCE DETERMINATION	
• CAPACITY CONTROL OVERRIDES	

CONTENTS (cont)

	Page
Head Pressure Control	27
• COMFORTLINK™ UNITS (With EXV)	
• UNITS WITH TXV	
Pumpout	27
• EXV UNITS	
• TXV UNITS	
Marquee Display Usage	29
Service Test	29
Configuring and Operating Dual Chiller Control	29
Temperature Reset	43
Demand Limit	45
• DEMAND LIMIT (2-Stage Switch Controlled)	
• EXTERNALLY POWERED DEMAND LIMIT (4 to 20 mA Controlled)	
• DEMAND LIMIT (CCN Loadshed Controlled)	
TROUBLESHOOTING	46-51
Compressor Protection Control System (CPCS) Board	46
Compressor Ground Current (CGC) Board (30GTN,R130-210, 230A-315A, and 330A/B-420A/B)	46
EXV Troubleshooting	46
• STEP 1 – CHECK PROCESSOR EXV OUTPUTS	
• STEP 2 — CHECK EXV WIRING	
• STEP 3 — CHECK RESISTANCE OF EXV MOTOR WINDINGS	
• STEP 4 — CHECK THERMISTORS THAT CONTROL EXV	
• STEP 5 — CHECK OPERATION OF THE EXV	
Alarms and Alerts	47
SERVICE	52-64
Electronic Components	52
Compressors	52
• COMPRESSOR REMOVAL	
• OIL CHARGE	
Cooler	52
• COOLER REMOVAL	
• REPLACING COOLER	
• SERVICING THE COOLER	
Condenser Coils	55
Condenser Fans	55
Refrigerant Feed Components	56
• ELECTRONIC EXPANSION VALVE (EXV)	
• MOISTURE-LIQUID INDICATOR	
• FILTER DRIER	
• LIQUID LINE SOLENOID VALVE	
• LIQUID LINE SERVICE VALVE	
Thermistors	57
• LOCATION	
• REPLACING THERMISTOR T2	
• REPLACING THERMISTORS T1,T5,T6,T7, AND T8	
• THERMISTORS T3 AND T4	
• THERMISTOR/TEMPERATURE SENSOR CHECK	
Safety Devices	63
• COMPRESSOR PROTECTION	
• LOW OIL PRESSURE PROTECTION	
• CRANKCASE HEATERS	
• COOLER PROTECTION	
Relief Devices	64
• HIGH-SIDE PROTECTION	
• LOW-SIDE PROTECTION	
• PRESSURE RELIEF VALVES	
Other Safeties	64
PRE-START-UP	64
System Check	64
START-UP AND OPERATION	65,66
Actual Start-Up	65

	Page
Operating Limitations	65
• TEMPERATURES	
• VOLTAGE	
• MINIMUM FLUID LOOP VOLUME	
• FLOW RATE REQUIREMENTS	
Operation Sequence	66
APPENDIX A — CCN TABLES	67-74
START-UP CHECKLIST	CL-1 to CL-8

GENERAL

Unit sizes 230-420 are modular units which are shipped as separate sections (modules A and B). Installation instructions specific to these units are shipped inside the individual modules. See Table 1 for a listing of unit sizes and modular combinations. For modules 230B-315B, follow all general instructions as noted for unit sizes 080-110. For all remaining modules, follow instructions for unit sizes 130-210.

INTRODUCTION

This publication contains Start-Up, Service, Controls, Operation, and Troubleshooting information for the 30GTN,R040-420 liquid chillers with *ComfortLink* controls.

The 30GTN,R chillers are equipped with electronic expansion valves (EXVs) or, on size 040-110 FIOP (factory-installed option) units, conventional thermostatic expansion valves (TXVs). The size 040-110 FIOP chillers are also equipped with liquid line solenoid valves (LLSV).

NOTE: TXVs are not available on modular units.

Differences in operations and controls between standard and 040-110 FIOP units are noted in appropriate sections in this publication. Refer to the Installation Instructions and the Wiring Diagrams for the appropriate unit for further details.

⚠ WARNING

This unit uses a microprocessor-based electronic control system. Do not use jumpers or other tools to short out or bypass components or otherwise depart from recommended procedures. Any short-to-ground of the control board or accompanying wiring may destroy the board or electrical component.

Table 1 — Unit Sizes and Modular Combinations

UNIT MODEL 30GTN,R	NOMINAL TONS	SECTION A UNIT 30GTN,R	SECTION B UNIT 30GTN,R
40	40	—	—
45	45	—	—
50	50	—	—
60	60	—	—
70	70	—	—
80	80	—	—
90	90	—	—
100	100	—	—
110	110	—	—
130	125	—	—
150	145	—	—
170	160	—	—
190	180	—	—
210	200	—	—
230	220	150	080
245	230	150	090
255	240	150	100
270	260	170	100
290	280	190	110
315	300	210	110
330	325	170	170
360	350	190	190/170*
390	380	210	190
420	400	210	210

*60 Hz units/50 Hz units.

MAJOR SYSTEM COMPONENTS

General — The 30GTN,R air-cooled reciprocating chillers contain the *ComfortLink™* electronic control system that controls and monitors all operations of the chiller.

The control system is composed of several components as listed in the sections below. See Fig. 1 for typical control box drawing. See Fig. 2-4 for control schematics.

Main Base Board (MBB) — See Fig. 5. The MBB is the heart of the *ComfortLink* control system. It contains the major portion of operating software and controls the operation of the machine. The MBB continuously monitors input/output channel information received from its inputs and from all other modules. The MBB receives inputs from thermistors T1-T6, T9, and T10. See Table 2. The MBB also receives the feedback inputs from compressors A1, A2, B1 and B2, and other status switches. See Table 3. The MBB also controls several outputs. Relay outputs controlled by the MBB are shown in Table 4. Information is transmitted between modules via a 3-wire communication bus or LEN (Local Equipment Network). The CCN (Carrier Comfort Network) bus is also supported. Connections to both LEN and CCN buses are made at TB3. See Fig. 5.

Expansion Valve (EXV) Board — The electronic expansion valve (EXV) board receives inputs from thermistors T7 and T8. See Table 2. The EXV board communicates with the MBB and directly controls the expansion valves to maintain the correct compressor superheat.

Compressor Expansion Board (CXB) — The compressor expansion board (CXB) receives the feedback inputs from compressors A3, B3 and A4. See Table 3. The CXB board communicates the status to the MBB and controls the outputs for these compressors. The CXB board can also be used as an accessory to control up to two field-installed accessory unloaders on 080-110, 130 (60 Hz), and 230B-315B sizes.

Scrolling Marquee Display — This device is the keypad interface used for accessing chiller information, reading sensor values, and testing the chiller. The marquee display is a 4-key, 4-character, 16-segment LED (light-emitting diode) display. Eleven mode LEDs are located on the display as well as an Alarm Status LED. See Marquee Display Usage section on page 29 for further details.

Energy Management Module (EMM) — The EMM module is available as a factory-installed option or as a field-installed accessory. The EMM module receives 4 to 20 mA inputs for the temperature reset, cooling set point reset and demand limit functions. The EMM module also receives the switch inputs for the field-installed 2-stage demand limit and ice done functions. The EMM module communicates the status of all inputs with the MBB, and the MBB adjusts the control point, capacity limit, and other functions according to the inputs received.

Enable/Off/Remote Contact Switch — The Enable/Off/Remote Contact switch is a 3-position switch used to control the chiller. When switched to the Enable position the chiller is under its own control. Move the switch to the Off position to shut the chiller down. Move the switch to the Remote Contact position and a field installed dry contact can be used to start the chiller. The contacts must be rated for dry circuit application capable of handling a 5 vdc, 1 to 20 mA load. In the Enable and Remote Contact (dry contacts closed) positions, the chiller is allowed to operate and respond to the scheduling configuration, CCN configuration and set point data. See Fig. 6.

Emergency On/Off Switch — The Emergency On/Off switch should only be used when it is required to shut the chiller off immediately. Power to the MBB, EMM, CXB, and marquee display is interrupted when this switch is off and all outputs from these modules will be turned off. The EXV board is powered separately, but expansion valves will be closed as a result of the loss of communication with the MBB. There is no pumpout cycle when this switch is used. See Fig. 6.

Reset Button — A reset button is located on the fuse/circuit breaker panel for unit sizes 130-210 and associated modules. The reset button must be pressed to reset either Circuit Ground Fault board in the event of a trip.

Board Addresses — The Main Base Board (MBB) has a 3-position Instance jumper that must be set to '1.' All other boards have 4-position DIP switches. All switches are set to 'On' for all boards.

Control Module Communication

RED LED — Proper operation of the control boards can be visually checked by looking at the red status LEDs (light-emitting diodes). When operating correctly, the red status LEDs should be blinking in unison at a rate of once every 2 seconds. If the red LEDs are not blinking in unison, verify that correct power is being supplied to all modules. Be sure that the Main Base Board (MBB) is supplied with the current software. If necessary, reload current software. If the problem still persists, replace the MBB. A board LED that is lit continuously or blinking at a rate of once per second or faster indicates that the board should be replaced.

GREEN LED — The MBB has one green LED. The Local Equipment Network (LEN) LED should always be blinking whenever power is on. All other boards have a LEN LED which should be blinking whenever power is on. Check LEN connections for potential communication errors at the board J3 and/or J4 connectors. Communication between modules is accomplished by a 3-wire sensor bus. These 3 wires run in parallel from module to module. The J4 connector on the MBB provides both power and communication directly to the marquee display only.

YELLOW LED — The MBB has one yellow LED. The Carrier Comfort Network (CCN) LED will blink during times of network communication.

Carrier Comfort Network (CCN) Interface — The 30GTN,R chiller units can be connected to the CCN if desired. The communication bus wiring is a shielded, 3-conductor cable with drain wire and is supplied and installed in the field. The system elements are connected to the communication bus in a daisy chain arrangement. The positive pin of each system element communication connector must be wired to the positive pins of the system elements on either side of it. This is also required for the negative and signal ground pins of each system element. Wiring connections for CCN should be made at TB3. Consult the CCN Contractor's Manual for further information.

NOTE: Conductors and drain wire must be 20 AWG (American Wire Gage) minimum stranded, tinned copper. Individual conductors must be insulated with PVC, PVC/nylon, vinyl, Teflon, or polyethylene. An aluminum/polyester 100% foil shield and an outer jacket of PVC, PVC/nylon, chrome vinyl, or Teflon with a minimum operating temperature range of -20 C to 60 C is required. Wire manufactured by Alpha (2413 or 5463), American (A22503), Belden (8772), or Columbia (02525) meets the above mentioned requirements.

It is important when connecting to a CCN communication bus that a color coding scheme be used for the entire network to simplify the installation. It is recommended that red be used for the signal positive, black for the signal negative, and white for the signal ground. Use a similar scheme for cables containing different colored wires.

At each system element, the shields of its communication bus cables must be tied together. If the communication bus is entirely within one building, the resulting continuous shield must be connected to a ground at one point only. If the communication bus cable exits from one building and enters another, the shields must be connected to grounds at the lightning suppressor in each building where the cable enters or exits the building (one point per building only). To connect the unit to the network:

1. Turn off power to the control box.
2. Cut the CCN wire and strip the ends of the red (+), white (ground), and black (–) conductors. (Substitute appropriate colors for different colored cables.)
3. Connect the red wire to (+) terminal on TB3 of the plug, the white wire to COM terminal, and the black wire to the (–) terminal.
4. The RJ14 CCN connector on TB3 can also be used, but is only intended for temporary connection (for example, a laptop computer running Service Tool).

IMPORTANT: A shorted CCN bus cable will prevent some routines from running and may prevent the unit from starting. If abnormal conditions occur, unplug the connector. If conditions return to normal, check the CCN connector and cable. Run new cable if necessary. A short in one section of the bus can cause problems with all system elements on the bus.

Table 2 — Thermistor Designations

THERMISTOR NO.	PIN CONNECTION POINT	THERMISTOR INPUT
T1	J8-13,14 (MBB)	Cooler Leaving Fluid
T2	J8-11,12 (MBB)	Cooler Entering Fluid
T3	J8-21,22 (MBB)	Saturated Condensing Temperature, Ckt A
T4	J8-15,16 (MBB)	Saturated Condensing Temperature, Ckt B
T5	J8-24,25 (MBB)	Cooler Suction Temperature, Ckt A (EXV Only)
T6	J8-18,19 (MBB)	Cooler Suction Temperature, Ckt B (EXV Only)
T7	J5-11,12 (EXV)	Compressor Suction Gas Temperature, Ckt A (EXV Only)
T8	J5-9,10 (EXV)	Compressor Suction Gas Temperature, Ckt B (EXV Only)
T9	J8-7,8 (MBB)	Outdoor-Air Temperature Sensor (Accessory)
T10	J8-5,6 (MBB)	Remote Space Temperature Sensor (Accessory)

LEGEND

EXV — Electronic Expansion Valve
MBB — Main Base Board

Table 3 — Status Switches

STATUS SWITCH	PIN CONNECTION POINT	040-060 (50 Hz) 040-070 (60 Hz)	070 (50 Hz) 080, 230B	090-110, 245B-315B	130 (60 Hz)	130 (50 Hz) 150, 230A-255A	170,190, 270A,290A,330A/B, 360A/B, 390B	210, 315A, 390A, 420A/B
Oil Pressure, Ckt B	J7-1, 2 (MBB)	Not Used*	OPSB	OPSB	OPSB	OPSB	OPSB	OPSB
Oil Pressure, Ckt A	J7-3, 4 (MBB)	Not Used*	OPSA	OPSA	OPSA	OPSA	OPSA	OPSA
Remote On/Off	TB5-13, 14	Field-Installed Relay Closure						
Compressor Fault Signal, B3	J5-8, 12 (CXB)	Not Used	Not Used	Not Used	Not Used	Not Used	CR-B3	CR-B3
Compressor Fault Signal, B2	J9-2, 12 (MBB)	Not Used	Not Used	CPCS-B2	CR-B2	CR-B2	CR-B2	CR-B2
Compressor Fault Signal, B1	J9-8, 12 (MBB)	CR/CPCS-B1†	CPCS-B1	CPCS-B1	CR-B1	CR-B1	CR-B1	CR-B1
Compressor Fault Signal, A4	J5-5, 12 (CXB)	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	CR-A4
Compressor Fault Signal, A3	J5-11, 12 (CXB)	Not Used	Not Used	Not Used	Not Used	CR-A3	CR-A3	CR-A3
Compressor Fault Signal, A2	J9-5, 12 (MBB)	Not Used	CPCS-A2	CPCS-A2	CR-A2	CR-A2	CR-A2	CR-A2
Compressor Fault Signal, A1	J9-11, 12 (MBB)	CR/CPCS-A1†	CPCS-A1	CPCS-A1	CR-A1	CR-A1	CR-A1	CR-A1

LEGEND

CPCS — Compressor Protection Control System
CR — Control Relay
CXB — Compressor Expansion Board
MBB — Main Base Board
OPS — Oil Pressure Switch, Circuit A or B

*The OPS can also be added as an accessory.

†The CPCS can be added as an accessory.

Table 4 — Output Relay

RELAY NO.	DESCRIPTION
K0 (MBB)	Energize Compressor A1 and OFM1 (040-110*) Energize Liquid Line Solenoid Valve for Ckt A (if used) (040-110*) Energize Compressor A1, OFM5, and OFM7 (130-210*)
K1 (MBB)	Energize Compressor B1 and OFM2 (040-110*) Energize Liquid Line Solenoid Valve for Ckt B (if used) (040-110*) Energize Compressor B1, OFM6, and OFM8 (130-210*)
K2 (MBB)	Energize Unloader A1 (040-170*) No Action (190-210*)
K3 (MBB)	Energize Unloader B1 (040-070†, 080-170*) No Action (190,210*)
K4 (MBB)	No Action (040-060, 50 Hz; 040-070, 60 Hz) Energize Compressor A2 (070, 50 Hz; 080-210*)
K5 (MBB)	No Action (040-080*) Energize Compressor B2 (090-210*)
K6 (MBB)	Alarm
K7 (MBB)	Cooler Pump
K8 (MBB)	Energize First Stage of Condenser Fans: 040-050 — OFM3 060-110* — OFM3, OFM4 130 (60 Hz) — OFM1, OFM2 Energize First Stage of Ckt A Condenser Fans: 130 (50 Hz), 150,170* — OFM1 190,210* — OFM1, OFM11
K9 (MBB)	Energize First Stage of Condenser Fans: 040-050 — OFM4 060-090* — OFM5, OFM6 100,110* — OFM5, OFM6, OFM7, OFM8 130 (60 Hz) — OFM3, OFM4, OFM9, OFM10 Energize First Stage of Ckt B Condenser Fans: 130 (50 Hz), 150,170* — OFM2 190,210* — OFM2, OFM12
K10 (MBB)	Hot Gas Bypass
K1 (CXB)	No Action (040-110*; 130, 60 Hz) Energize Compressor A3 (130, 50 Hz; 150-210*)
K2 (CXB)	No Action (040-150*) Energize Compressor B3 (170-210*)
K3 (CXB)	Energize Compressor A4 (210*) Energize Accessory Unloader A2 (080-110*)
K4 (CXB)	Energize Accessory Unloader B2 (080-110*)
K5 (CXB)	Energize Second Stage of Ckt A Condenser Fans: 130 (50 Hz), 150-210* — OFM3, OFM9
K6 (CXB)	Energize Second Stage of Ckt B Condenser Fans: 130 (50 Hz), 150-210* — OFM4, OFM10

LEGEND

OFM — Outdoor-Fan Motor

*And associated modular units.

†Field-installed accessory unloader.

LEGEND FOR FIG. 1-4

C	— Compressor Contactor
CB	— Circuit Breaker
CCN	— Carrier Comfort Network
CGF	— Compressor Ground Fault
CHT	— Cooler Heater Thermostat
CKT	— Circuit
CLHR	— Cooler Heater Relay
CPCS	— Compressor Protection and Control System
CWF	— Chilled Water Flow Switch
CWP	— Chilled Water Pump
CR	— Control Relay
CXB	— Compressor Expansion Board
EQUIP GND	— Equipment Ground
FB	— Fuse Block
FC	— Fan Contactor
FCB	— Fan Circuit Breaker
FIOP	— Factory-Installed Option Package
EMM	— Energy Management Module
EXV	— Electronic Expansion Valve
FCB	— Fan Circuit Breaker
HPS	— High-Pressure Switch
LCS	— Loss-of-Charge Switch
MBB	— Main Base Board
NEC	— National Electrical Code
OAT	— Outdoor-Air Temperature
OPS	— Oil Pressure Switch
PL	— Plug
PW	— Part Wind
SN	— Sensor (Toroid)
SPT	— Space Temperature
TRAN	— Transformer
SW	— Switch
TB	— Terminal Block
TDR	— Time Delay Relay
TXV	— Thermostatic Expansion Valve
UL	— Unloader
XL	— Across-the-Line

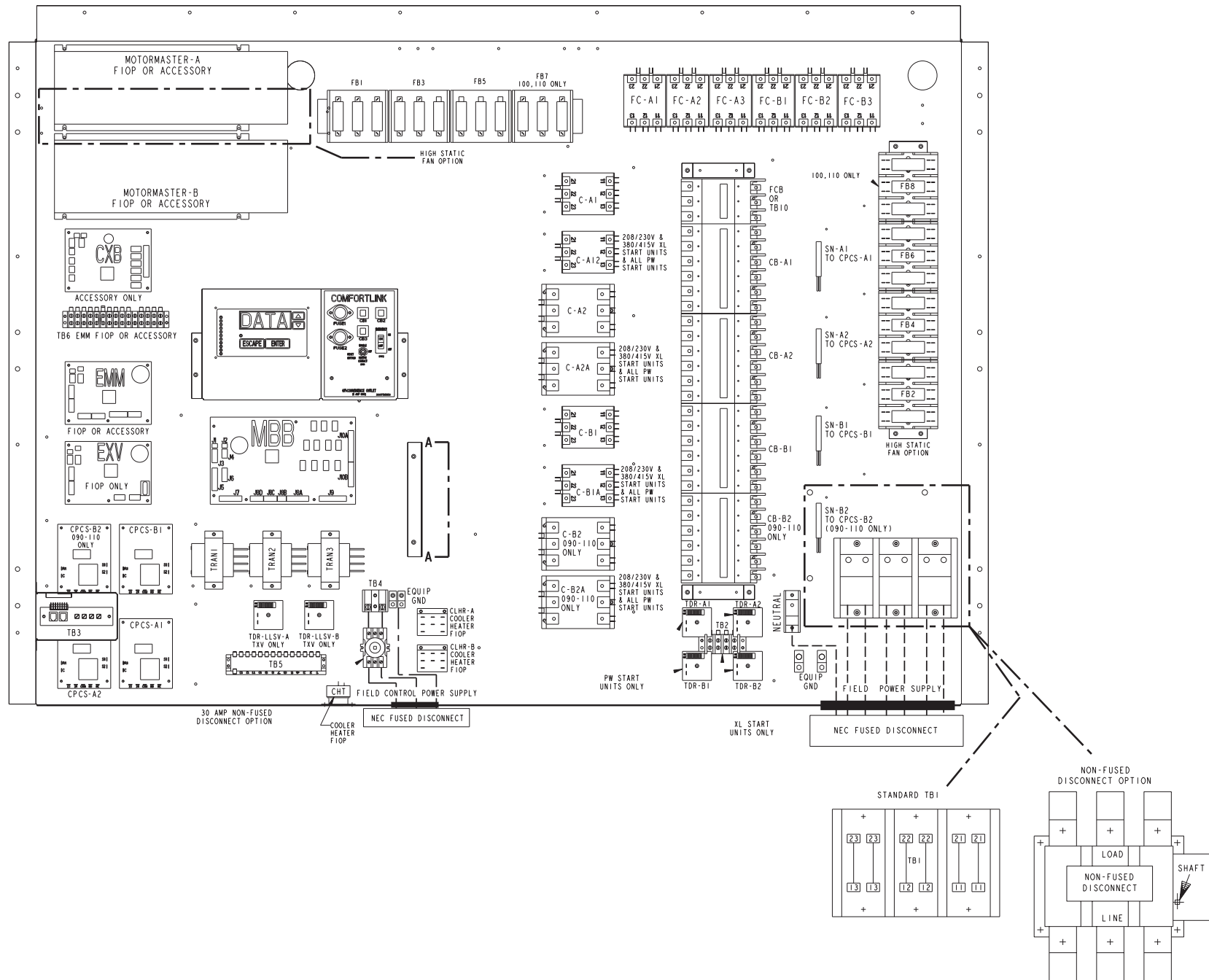


Fig. 1 — Typical Control Box (080-110 and Associated Modular Units Shown)

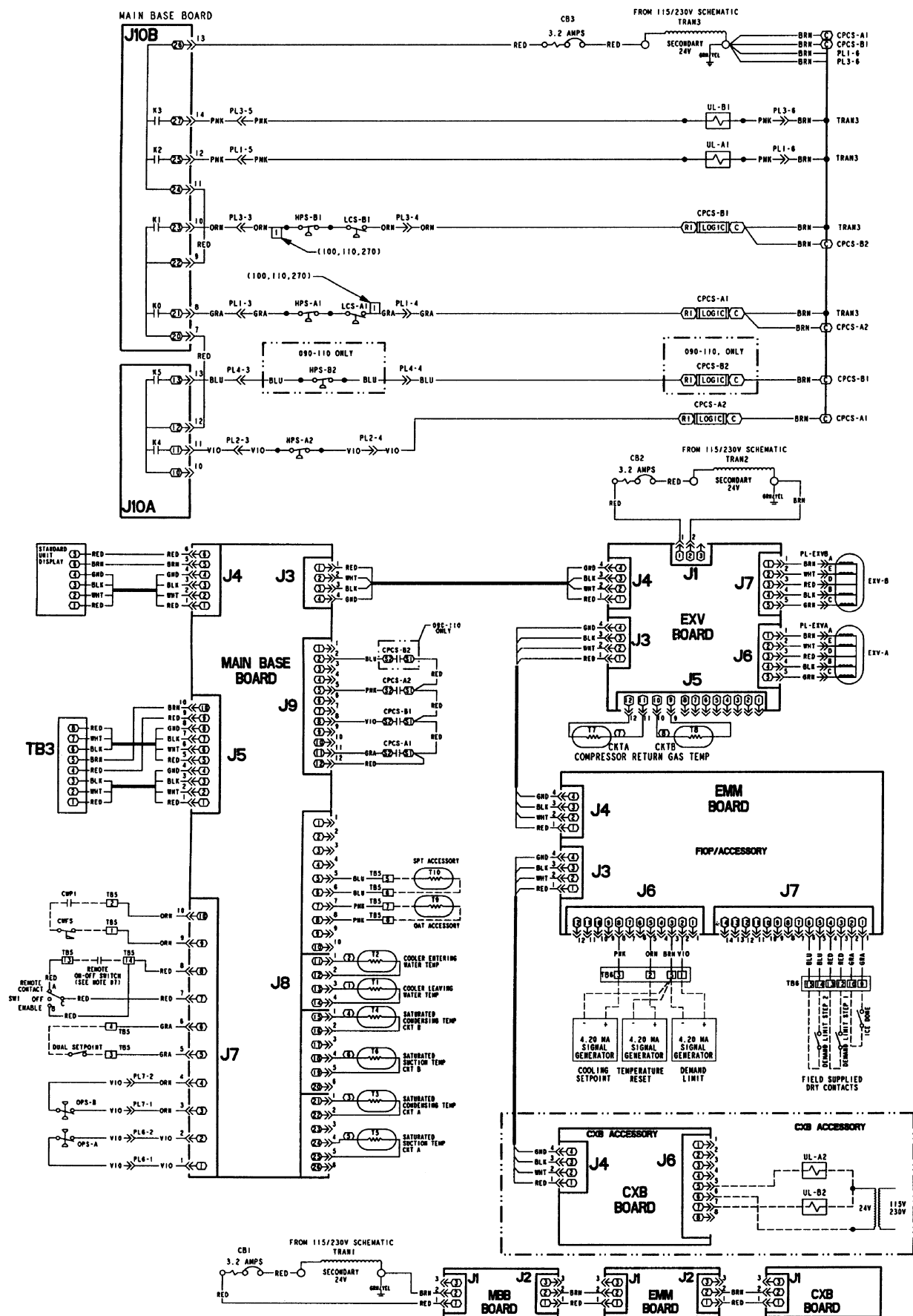


Fig. 3 — 24 V Control Schematic, Unit Sizes 080-110, 230B-315B



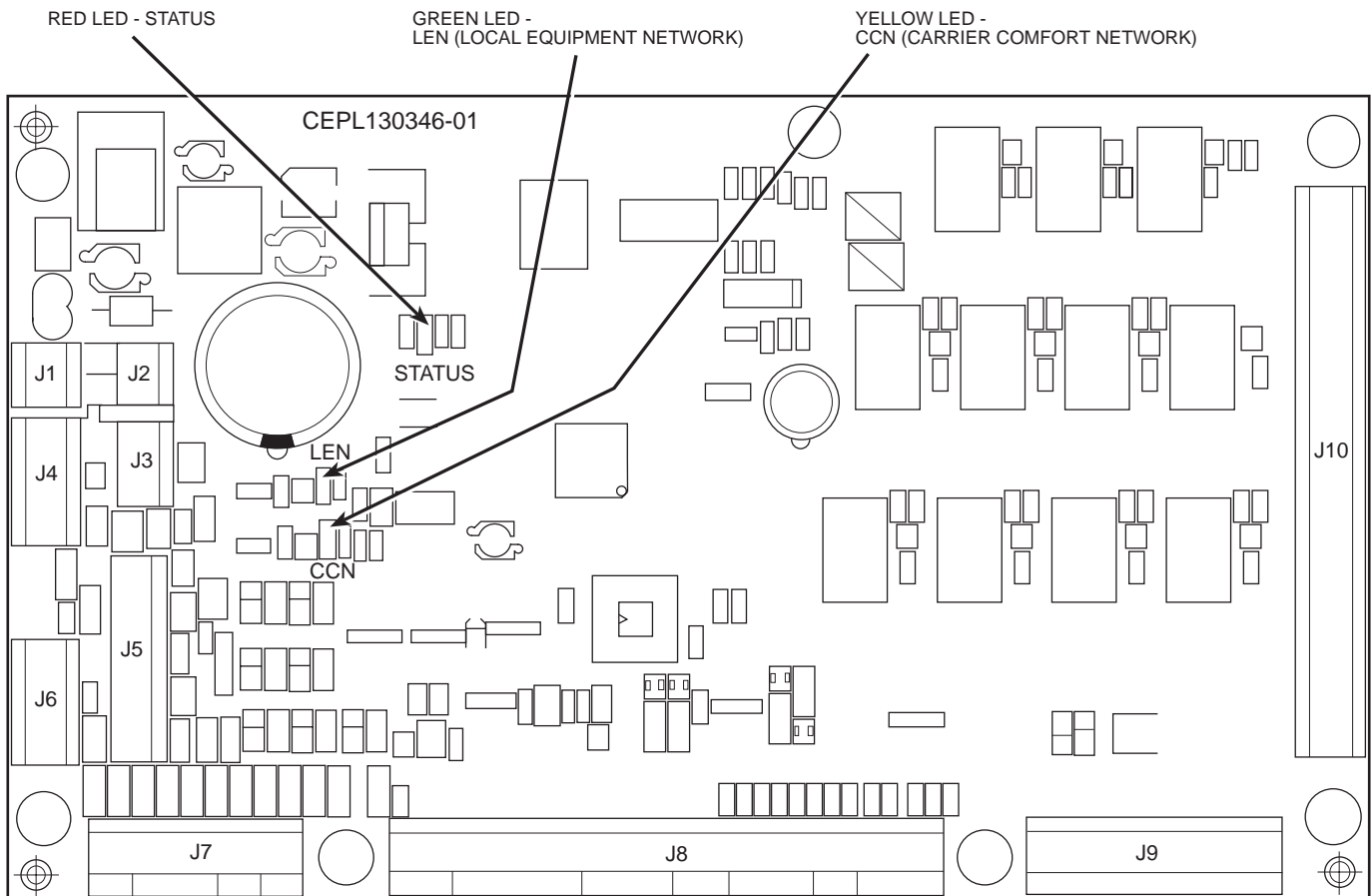


Fig. 5 — Main Base Board

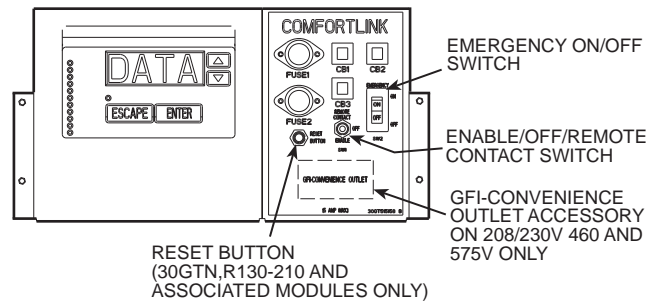


Fig. 6 — Enable/Off/Remote Contact Switch, Emergency On/Off Switch, and Reset Button Locations

OPERATING DATA

Sensors — The electronic control uses 4 to 10 thermistors to sense temperatures for controlling chiller operation. See Table 2. These sensors are outlined below. See Fig. 7 - 10 for thermistor locations. Thermistors T1-T9 are 5 k Ω at 25 C (77 F) and are identical in temperature versus resistance and voltage drop performance. Thermistor T10 is a 10 k Ω at 25 C (77 F) and has a different temperature vs resistance and voltage drop performance. See Thermistors section on page 55 for temperature-resistance-voltage drop characteristics.

T1 — COOLER LEAVING FLUID SENSOR — This thermistor is located in the leaving fluid nozzle. The thermistor probe is inserted into a friction-fit well. The sensor well is located directly in the refrigerant path.

T2 — COOLER ENTERING FLUID SENSOR — This thermistor is located in the cooler shell in the first baffle space in close proximity to the cooler tube bundle.

T3, T4 — SATURATED CONDENSING TEMPERATURE SENSORS — These 2 thermistors are clamped to the outside of a return bend of the condenser coils.

T5, T6 — COOLER SUCTION TEMPERATURE SENSORS — These thermistors are located next to the refrigerant inlet in the cooler head, and are inserted into a friction-fit well. The sensor well is located directly in the refrigerant path. These thermistors are not used on units with TXVs.

T7, T8 — COMPRESSOR SUCTION GAS TEMPERATURE SENSORS — These thermistors are located in the lead compressor in each circuit in a suction passage after the refrigerant has passed over the motor and is about to enter the cylinders. These thermistors are inserted into friction-fit wells. The sensor wells are located directly in the refrigerant path. These thermistors are not used on units with TXVs.

T9 — OUTDOOR-AIR TEMPERATURE SENSOR — Sensor T9 is an accessory sensor that is remotely mounted and used for outdoor-air temperature reset.

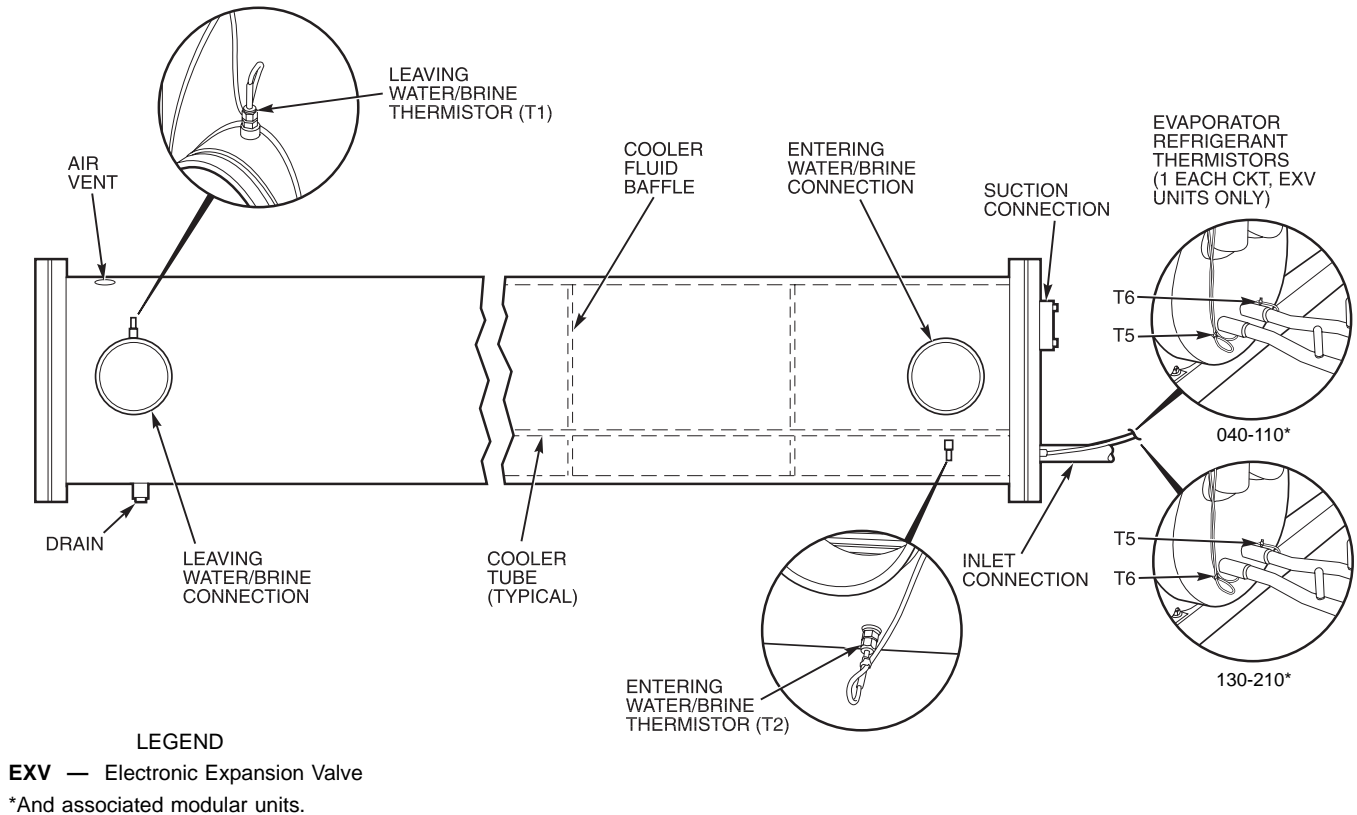
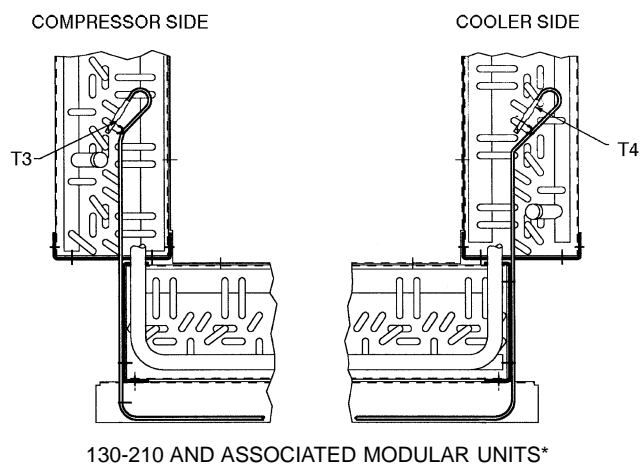
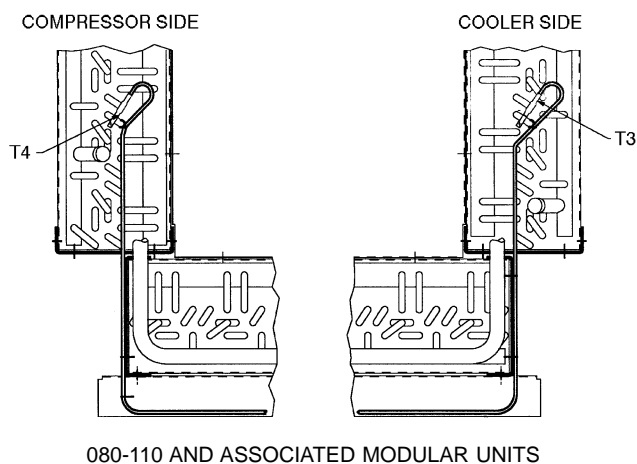
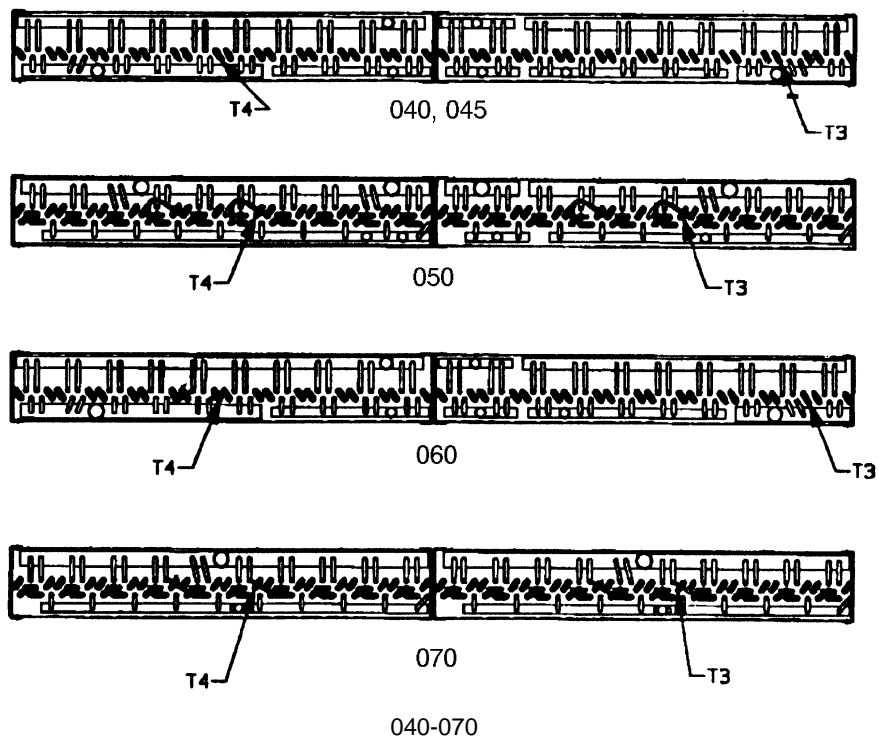
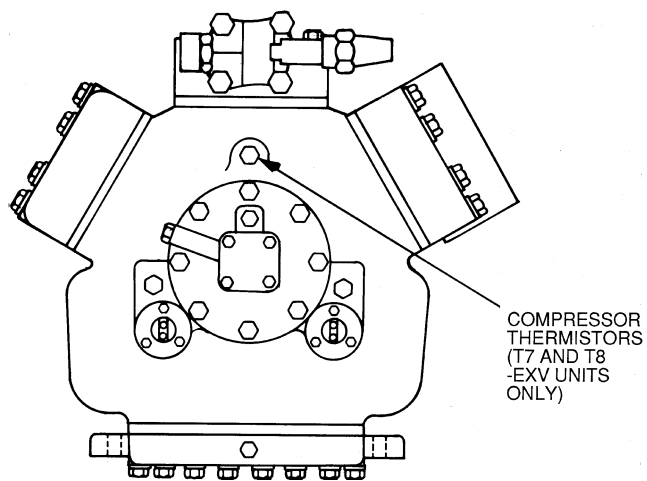


Fig. 7 — Cooler Thermistor Locations



*When thermistor is viewed from perspective where the compressor is on the left and the cooler is on the right.

Fig. 8 — Thermistor T3 and T4 Locations



LEGEND
EXV — Electronic Expansion Valve

Fig. 9 — Compressor Thermistor Locations (T7 and T8)

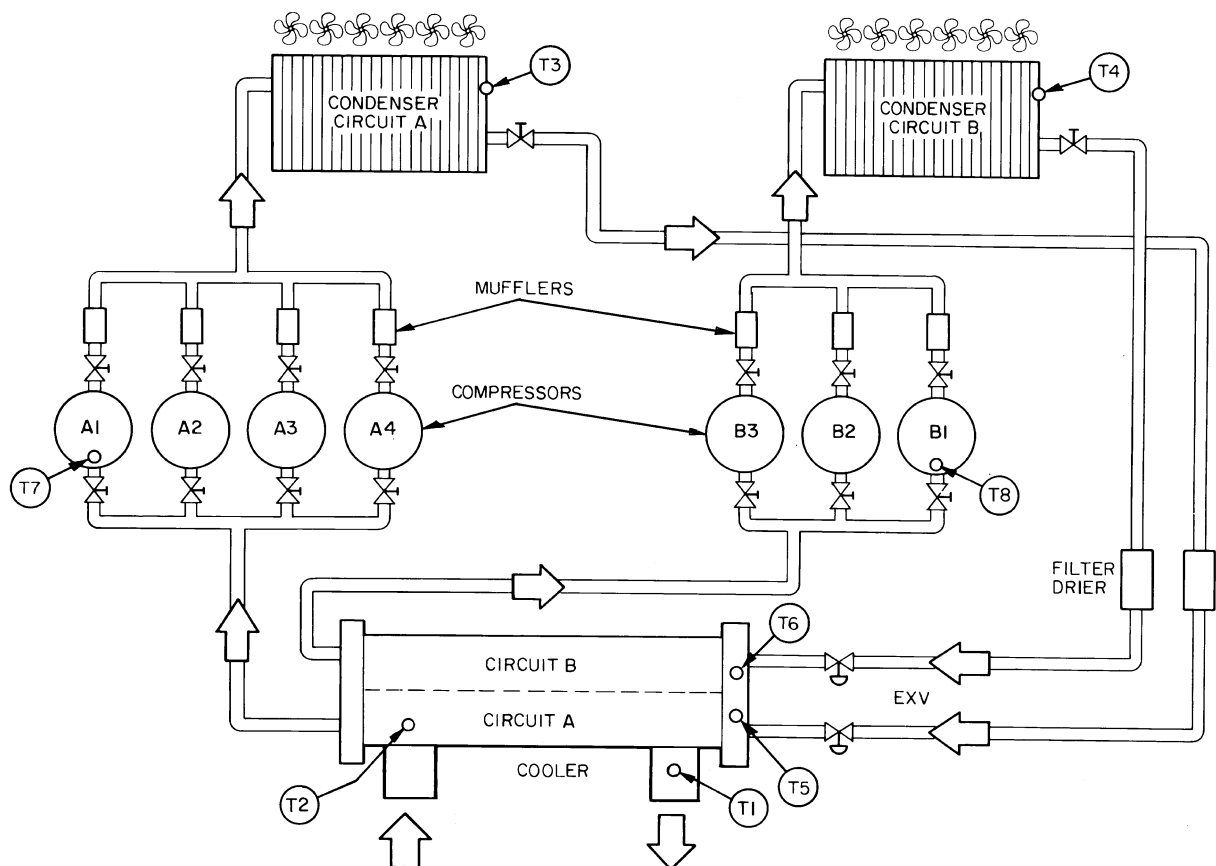


Fig. 10 — Typical Thermistor Location (30GTN,R210, 315A, 390A, 420A/B Shown)

T10 — REMOTE SPACE TEMPERATURE SENSOR — Sensor T10 (part no. HH51BX006) is an accessory sensor that is remotely mounted in the controlled space and used for space temperature reset. The sensor should be installed as a wall-mounted thermostat would be (in the conditioned space where it will not be subjected to either a cooling or heating source or direct exposure to sunlight, and 4 to 5 ft above the floor). The push button override is not supported by the *ComfortLink™* Controls.

Space temperature sensor wires are to be connected to terminals in the unit main control box. The space temperature sensor includes a terminal block (SEN) and a RJ11 female connector. The RJ11 connector is used to tap into the Carrier Comfort Network (CCN) at the sensor.

To connect the space temperature sensor (Fig. 11):

1. Using a 20 AWG twisted pair conductor cable rated for the application, connect 1 wire of the twisted pair to one SEN terminal and connect the other wire to the other SEN terminal located under the cover of the space temperature sensor.
2. Connect the other ends of the wires to terminals 5 and 6 on TB5 located in the unit control box.

Units on the CCN can be monitored from the space at the sensor through the RJ11 connector, if desired. To wire the RJ11 connector into the CCN (Fig. 12):

IMPORTANT: The cable selected for the RJ11 connector wiring **MUST** be identical to the CCN communication bus wire used for the entire network. Refer to table below for acceptable wiring.

MANUFACTURER	PART NO.	
	Regular Wiring	Plenum Wiring
Alpha	1895	—
American	A21451	A48301
Belden	8205	884421
Columbia	D6451	—
Manhattan	M13402	M64430
Quabik	6130	—

1. Cut the CCN wire and strip ends of the red (+), white (ground), and black (–) conductors. (If another wire color scheme is used, strip ends of appropriate wires.)
2. Insert and secure the red (+) wire to terminal 5 of the space temperature sensor terminal block.

3. Insert and secure the white (ground) wire to terminal 4 of the space temperature sensor.
4. Insert and secure the black (–) wire to terminal 2 of the space temperature sensor.
5. Connect the other end of the communication bus cable to the remainder of the CCN communication bus.

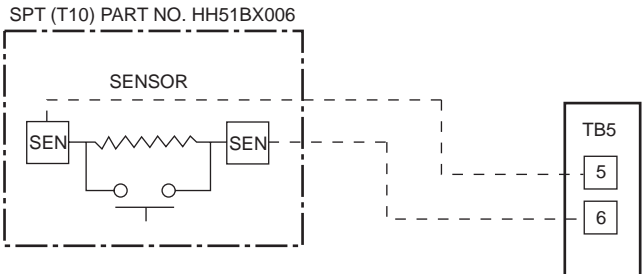


Fig. 11 — Typical Space Temperature Sensor Wiring

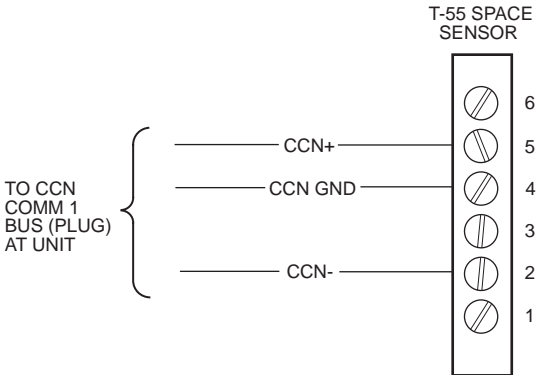


Fig. 12 — CCN Communications Bus Wiring to Optional Space Sensor RJ11 Connector

Thermostatic Expansion Valves (TXV) — Model 30GTN,R040-110 units are available from the factory with conventional TXVs with liquid line solenoids. The liquid line solenoid valves are not intended to be a mechanical shut-off. When service is required, use the liquid line service valve to pump down the system.

NOTE: This option is not available for modular units.

The TXV is set at the factory to maintain approximately 8 to 12° F (4.4 to 6.7° C) suction superheat leaving the cooler by monitoring the proper amount of refrigerant into the cooler. All TXVs are adjustable, *but should not be adjusted unless absolutely necessary*. When TXV is used, thermistors T5, T6, T7, and T8 are not required.

The TXV is designed to limit the cooler saturated suction temperature to 55 F (12.8 C). This makes it possible for unit to start at high cooler fluid temperatures without overloading the compressor.

Compressor Protection Control System (CPCS) or Control Relay (CR) — Each compressor has its own CPCS module or CR. See Fig. 13 for CPCS module. The CPCS or CR is used to control and protect the compressors and crankcase heaters. The CPCS and CR provide the following functions:

- compressor contactor control/crankcase heater
- crankcase heater control
- compressor ground current protection (CPCS only)
- status communication to processor board
- high-pressure protection

One large relay is located on the CPCS board. This relay controls the crankcase heater and compressor contactor, and also provides a set of signal contacts that the microprocessor monitors to determine the operating status of the compressor. If the processor board determines that the compressor is not operating properly through the signal contacts, it will lock the compressor off by deenergizing the proper 24-v control relay on the relay board. The CPCS board contains logic that can detect if the current-to-ground of any compressor winding exceeds 2.5 amps. If this condition occurs, the CPCS shuts down the compressor.

A high-pressure switch is wired in series between the MBB and the CR or CPCS. On compressor A1 and B1 a loss-of-charge switch is also wired in series with the high-pressure switch. If the high-pressure switch opens during operation of a compressor, the compressor will be stopped, the failure

will be detected through the signal contacts, and the compressor will be locked off. If the lead compressor in either circuit is shut down by the high-pressure switch, loss-of-charge switch, ground current protector, or oil safety switch, all compressors in that circuit are shut down.

NOTE: The CR operates the same as the CPCS, except the ground current circuit protection is not provided.

Compressor Ground Current Protection Board (CGF) and Control Relay (CR) — The 30GTN,R130-210, and associated modular units (see Table 1) contain one compressor ground current protection board (CGF) for each refrigeration circuit. The CGF contains logic that can detect if the current-to-ground of any compressor winding exceeds 2.5 amps. If this occurs, the lead compressor in that circuit is shut down along with other compressors in that circuit.

A high-pressure switch is wired in series between the MBB and the CR or CPCS. On compressor A1 and B1 a loss-of-charge switch is also included with the high-pressure switch. The lead compressor in each circuit also has the CGF contacts described above. If any of these switches open during operation of a compressor, the CR relay is deenergized, stopping the compressor and signaling the processor at the MBB-J9 inputs to lock out the compressor. If the lead compressor in either circuit is shut down by high-pressure switch, compressor ground fault, oil pressure switch, or the loss-of-charge switch, all compressors in that circuit are also shut down.

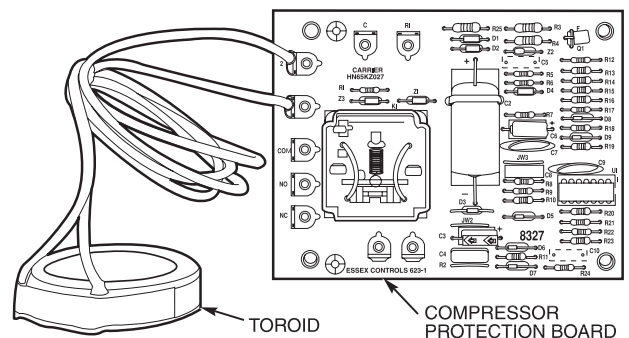


Fig. 13 — Compressor Protection Control System Module

Electronic Expansion Valve (EXV) (See Fig. 14)

— Standard units are equipped with a bottom seal EXV. This device eliminates the use of the liquid line solenoid pump-down at unit shutdown. An O-ring has been added to bottom of orifice assembly to complete a seal in the valve on shutdown. This is not a mechanical shut-off. When service is required, use the liquid line service valve to pump down the system.

High pressure refrigerant enters bottom of valve where it passes through a group of machined slots in side of orifice assembly. As refrigerant passes through the orifice, it drops in pressure. To control flow of refrigerant, the sleeve slides up and down along orifice assembly, modulating the size of orifice. The sleeve is moved by a linear stepper motor that moves in increments controlled directly by the processor. As stepper motor rotates, the motion is translated into linear movement of lead screw. There are 1500 discrete steps with this combination. The valve orifice begins to be exposed at 320 steps. Since there is not a tight seal with the orifice and the sleeve, the minimum position for operation is 120 steps.

Two thermistors are used to determine suction superheat. One thermistor is located in the cooler and the other is located in the cylinder end of the compressor after refrigerant has passed over the motor. The difference between the 2 thermistors is the suction superheat. These machines are set up to provide approximately 5 to 7 F (2.8 to 3.9 C) superheat leaving the cooler. Motor cooling accounts for approximately 22 F (12.2 C), resulting in a superheat entering compressor cylinders of approximately 30 F (16.7 C). This increases performance of cooler by reducing the amount of superheat needed.

Because the valves are controlled by the EXV module, it is possible to track the position of the valve. Valve position can be used to control head pressure and system refrigerant charge.

During initial start-up, the EXV module will drive each valve fully closed. After initialization period, valve position is controlled by the EXV module and the MBB.

The EXV is used to limit the maximum cooler saturated suction temperature to 55 F (12.8 C). This makes it possible for the chiller to start at high cooler fluid temperatures without overloading the compressor.

Energy Management Module (Fig. 15) — This factory-installed option or field-installed accessory is used for the following types of temperature reset, demand limit, and/or ice features:

- 4 to 20 mA leaving fluid temperature reset (requires field-supplied 4 to 20 mA generator)
- 4 to 20 mA cooling set point reset (requires field-supplied 4 to 20 mA generator)
- Discrete inputs for 2-step demand limit (requires field-supplied dry contacts capable of handling a 5 vdc, 1 to 20 mA load)
- 4 to 20 mA demand limit (requires field-supplied 4 to 20 mA generator)
- Discrete input for Ice Done switch (requires field-supplied dry contacts capable of handling a 5 vdc, 1 to 20 mA load)

See Demand Limit and Temperature Reset sections on pages 43 and 45 for further details.

Capacity Control — The control system cycles compressors, unloaders, and hot gas bypass solenoids to maintain the user-configured leaving chilled fluid temperature set point. Entering fluid temperature is used by the Main Base Board (MBB) to determine the temperature drop across the cooler and is used in determining the optimum time to add or subtract capacity stages. The chilled fluid temperature set point can be automatically reset by the return temperature

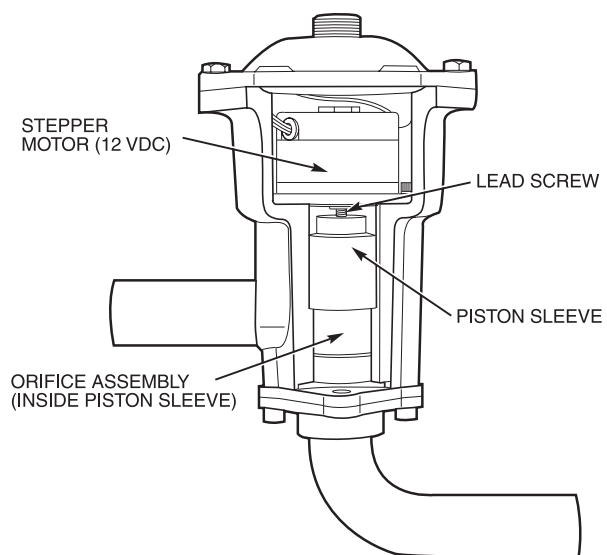


Fig. 14 — Electronic Expansion Valve (EXV)

reset or space and outdoor-air temperature reset features. It can also be reset from an external 4 to 20 mA signal (requires Energy Management Module FIOF/accessory).

With the automatic lead-lag feature in the unit, the control determines randomly which circuit will start first, A or B. At the first call for cooling, the lead compressor crankcase heater will be deenergized, a condenser fan will start, and the compressor will start unloaded.

NOTE: The automatic lead-lag feature is only operative when an even number of unloaders is present. The 040-070 units require an accessory unloader for the lead-lag feature to be in effect.

If the circuit has been off for 15 minutes, and the unit is a TXV unit, liquid line solenoid will remain closed during start-up of each circuit for 15 seconds while the cooler and suction lines are purged of any liquid refrigerant. For units with EXVs, the lead compressor will be signaled to start. The EXV will remain at minimum position for 10 seconds before it is allowed to modulate.

After the purge period, the EXV will begin to meter the refrigerant, or the liquid line solenoid will open allowing the TXV to meter the refrigerant to the cooler. If the off-time is less than 15 minutes, the EXV will be opened as soon as the compressor starts.

The EXVs will open gradually to provide a controlled start-up to prevent liquid flood-back to the compressor. During start-up, the oil pressure switch is bypassed for 2 minutes to allow for the transient changes during start-up. As additional stages of compression are required, the processor control will add them. See Tables 5A and 5B.

If a circuit is to be stopped, the control will first start to close the EXV or close the liquid line solenoid valve.

For units with TXVs, the lag compressor(s) will be shut down and the lead compressor will continue to operate for 10 seconds to purge the cooler of any refrigerant.

For units with EXVs, the lag compressor(s) will be shut down and the lead compressor will continue to run. After the lag compressor(s) has shut down, the EXV is signaled to close. The lead compressor will remain on for 10 seconds after the EXV is closed.

During both algorithms (TXV and EXV), all diagnostic conditions will be honored. If a safety trip or alarm condition is detected before pumpdown is complete, the circuit will be shut down.

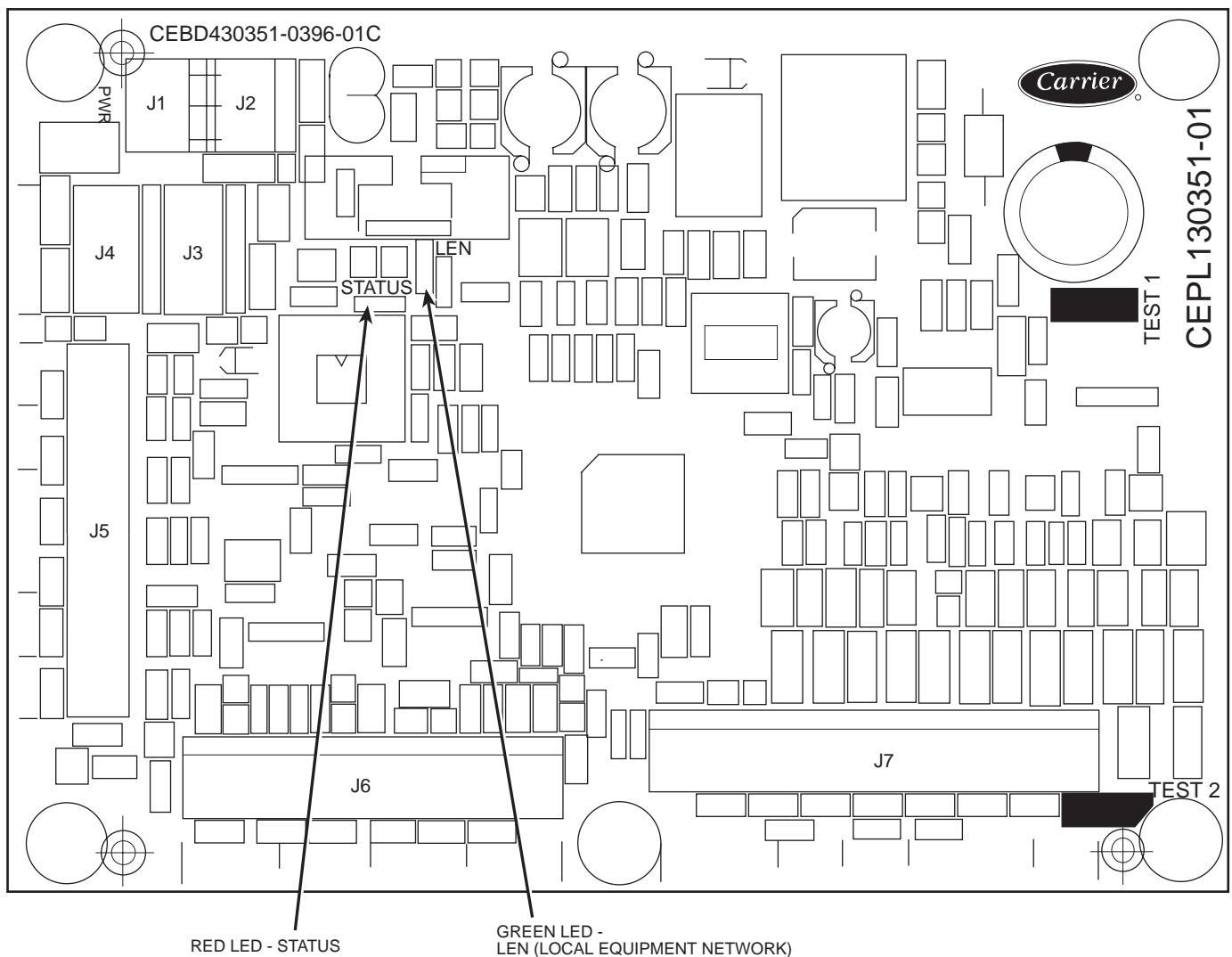


Fig. 15 — Energy Management Module

The capacity routine runs every 30 seconds. The routine attempts to maintain the Control Point at the desired set point. Each time it runs, the control reads the entering and leaving fluid temperatures. The control determines the rate at which conditions are changing and calculates 2 variables based on these conditions. Next, a capacity ratio is calculated using the 2 variables to determine whether or not to make any changes to the current stages of capacity. This ratio value ranges from

–100 to + 100%. If the next stage of capacity is a compressor, the control starts (stops) a compressor when the ratio reaches + 100% (–100%). If the next stage of capacity is an unloader, the control deenergizes (energizes) an unloader when the ratio reaches + 60% (–60%). Unloaders are allowed to cycle faster than compressors, to minimize the number of starts and stops on each compressor. A delay of 90 seconds occurs after each capacity step change.

Table 5A — Part Load Data Percent Displacement, Standard Units

UNIT 30GTN,GTR	CONTROL STEPS	LOADING SEQUENCE A		LOADING SEQUENCE B	
		% Displacement (Approx)	Compressors	% Displacement (Approx)	Compressors
040 (60 Hz)	1	25	A1*	—	—
	2	50	A1	—	—
	3	75	A1*, B1	—	—
	4	100	A1,B1	—	—
040 (50 Hz) 045 (60 Hz)	1	24	A1*	—	—
	2	47	A1	—	—
	3	76	A1*,B1	—	—
	4	100	A1,B1	—	—
045 (50 Hz) 050 (60 Hz)	1	31	A1*	—	—
	2	44	A1	—	—
	3	87	A1*,B1	—	—
	4	100	A1,B1	—	—
050 (50 Hz) 060 (60 Hz)	1	28	A1*	—	—
	2	42	A1	—	—
	3	87	A1*,B1	—	—
	4	100	A1,B1	—	—
060 (50 Hz) 070 (60 Hz)	1	33	A1*	—	—
	2	50	A1	—	—
	3	83	A1*,B1	—	—
	4	100	A1,B1	—	—
070 (50 Hz)	1	19	A1*	—	—
	2	27	A1	—	—
	3	65	A1*,B1	—	—
	4	73	A1,B1	—	—
	5	92	A1*,A2,B1	—	—
	6	100	A1,A2,B1	—	—
080, 230B (60 Hz)	1	22	A1*	30	B1*
	2	34	A1	44	B1
	3	52	A1*,B1*	52	A1*,B1*
	4	67	A1*,B1	63	A1,B1*
	5	78	A1,B1	78	A1,B1
	6	89	A1*,A2,B1	85	A1,A2,B1*
	7	100	A1,A2,B1	100	A1,A2,B1
080, 230B (50 Hz)	1	17	A1*	25	B1*
	2	25	A1	38	B1
	3	42	A1*,B1*	42	A1*,B1*
	4	54	A1*,B1	50	A1, B1*
	5	62	A1,B1	62	A1,B1
	6	79	A1*,A2,B1*	79	A1*,A2,B1*
	7	92	A1*,A2,B1	88	A1,A2,B1*
	8	100	A1,A2,B1	100	A1,A2,B1
090, 245B (60 Hz)	1	18	A1*	18	B1*
	2	27	A1	27	B1
	3	35	A1*,B1*	35	A1*,B1*
	4	44	A1*,B1	44	A1,B1
	5	53	A1,B1	53	A1,B1
	6	56	A1*,A2,B1*	62	A1*,B1*,B2
	7	65	A1*,A2,B1	71	A1,B1*,B2
	8	74	A1,A2,B1	80	A1,B1,B2
	9	82	A1*,A2,B1*,B2	82	A1*,A2,B1*,B2
	10	91	A1*,A2,B1,B2	91	A1,A2,B1*,B2
	11	100	A1,A2,B1,B2	100	A1,A2,B1,B2
090, 245B (50 Hz)	1	14	A1*	14	B1*
	2	21	A1	21	B1
	3	29	A1*,B1*	29	A1*,B1*
	4	36	A1*,B1	36	A1,B1*
	5	43	A1,B1	43	A1,B1
	6	61	A1*,A2,B1*	53	A1*,B1*,B2
	7	68	A1*,A2,B1	60	A1,B1*,B2
	8	75	A1,A2,B1	67	A1,B1,B2
	9	86	A1*,A2,B1*,B2	86	A1*,A2,B1*,B2
	10	93	A1*,A2,B1,B2	93	A1,A2,B1*,B2
	11	100	A1,A2,B1,B2	100	A1,A2,B1,B2
100, 255B, 270B (60 Hz)	1	16	A1*	16	A1*
	2	23	A1	23	A1
	3	31	A1*,B1*	31	A1*,B1*
	4	39	A1*,B1	39	A1*,B1
	5	46	A1,B1	46	A1,B1
	6	58	A1*,A2,B1*	58	A1*,A2,B1*
	7	66	A1*,A2,B1	66	A1*,A2,B1
	8	73	A1,A2,B1	73	A1,A2,B1
	9	85	A1*,A2,B1*,B2	85	A1*,A2,B1*,B2
	10	92	A1*,A2,B1,B2	92	A1*,A2,B1,B2
	11	100	A1,A2,B1,B2	100	A1,A2,B1,B2

*Unloaded compressor.

NOTE: These capacity control steps may vary due to lag compressor sequencing.

Table 5A — Part Load Data Percent Displacement, Standard Units (cont)

UNIT 30GTN,GTR	CONTROL STEPS	LOADING SEQUENCE A		LOADING SEQUENCE B	
		% Displacement (Approx)	Compressors	% Displacement (Approx)	Compressors
100, 255B, 270B (50 Hz)	1	13	A1*	13	B1*
	2	20	A1	20	B1
	3	26	A1*,B1*	26	A1*,B1*
	4	33	A1,B1	33	A1,B1
	5	40	A1,B1	40	A1,B1
	6	57	A1*,A2,B1*	57	A1*,B1*,B2
	7	63	A1*,A2,B1	63	A1,B1*,B2
	8	70	A1,A2,B1	70	A1,B1,B2
	9	87	A1*,A2,B1*,B2	87	A1*,A2,B1*,B2
	10	93	A1*,A2,B1,B2	93	A1,A2,B1*,B2
	11	100	A1,A2,B1,B2	100	A1,A2,B1,B2
110, 290B, 315B (60 Hz)	1	14	A1*	14	B1*
	2	21	A1	21	B1
	3	29	A1*,B1*	29	A1*,B1*
	4	36	A1*,B1	36	A1,B1*
	5	43	A1,B1	43	A1,B1
	6	61	A1*,A2,B1*	53	A1*,B1*,B2
	7	68	A1*,A2,B1	60	A1,B1*,B2
	8	75	A1,A2,B1	67	A1,B1,B2
	9	86	A1*,A2,B1*,B2	86	A1*,A2,B1*,B2
	10	93	A1*,A2,B1,B2	93	A1,A2,B1*,B2
	11	100	A1,A2,B1,B2	100	A1,A2,B1,B2
110, 290B, 315B (50 Hz)	1	17	A1*	17	B1*
	2	25	A1	25	B1
	3	33	A1*,B1*	33	A1*,B1*
	4	42	A1*,B1	42	A1,B1*
	5	50	A1,B1	50	A1,B1
	6	58	A1*,A2,B1*	58	A1*,B1*,B2
	7	67	A1*,A2,B1	67	A1,B1*,B2
	8	75	A1,A2,B1	75	A1,B1,B2
	9	83	A1*,A2,B1*,B2	83	A1*,A2,B1*,B2
	10	92	A1*,A2,B1,B2	92	A1,A2,B1*,B2
	11	100	A1,A2,B1,B2	100	A1,A2,B1,B2
130 (60 Hz)	1	14	A1*	14	B1*
	2	21	A1	21	B1
	3	28	A1*,B1*	28	A1*,B1*
	4	35	A1*,B1	35	A1,B1*
	5	42	A1,B1	42	A1,B1
	6	58	A1*,A2,B1*	58	A1*,B1*,B2
	7	64	A1*,A2,B1	64	A1,B1*,B2
	8	71	A1,A2,B1	71	A1,B1,B2
	9	87	A1*,A2,B1*,B2	87	A1*,A2,B1*,B2
	10	93	A1*,A2,B1,B2	93	A1,A2,B1*,B2
	11	100	A1,A2,B1,B2	100	A1,A2,B1,B2
130 (50 Hz)	1	10	A1*	16	B1*
	2	14	A1	25	B1
	3	26	A1*,B1*	26	A1*,B1*
	4	35	A1*,B1	31	A1,B1*
	5	39	A1,B1	39	A1,B1
	6	44	A1*,A2,B1*	51	A1*,B1*,B2
	7	53	A1*,A2,B1	56	A1,B1*,B2
	8	57	A1,A2,B1	64	A1,B1,B2
	9	69	A1*,A2,B1*,B2	69	A1*,A2,B1*,B2
	10	78	A1*,A2,B1,B2	74	A1,A2,B1*,B2
	11	82	A1,A2,B1,B2	82	A1,A2,B1,B2
	12	87	A1*,A2,A3,B1*,B2	87	A1*,A2,A3,B1*,B2
	13	96	A1*,A2,A3,B1,B2	91	A1,A2,A3,B1*,B2
	14	100	A1,A2,A3,B1,B2	100	A1,A2,A3,B1,B2
150, 230A, 245A, 255A (60 Hz)	1	11	A1*	18	B1*
	2	15	A1	27	B1
	3	29	A1*,B1*	29	A1*,B1*
	4	38	A1*,B1	33	A1,B1*
	5	42	A1,B1	42	A1,B1
	6	44	A1*,A2,B1*	55	A1*,B1*,B2
	7	53	A1*,A2,B1	60	A1,B1*,B2
	8	58	A1,A2,B1	69	A1,B1,B2
	9	71	A1*,A2,B1*,B2	71	A1*,A2,B1*,B2
	10	80	A1*,A2,B1,B2	75	A1,A2,B1*,B2
	11	85	A1,A2,B1,B2	85	A1,A2,B1,B2
	12	86	A1*,A2,A3,B1*,B2	86	A1*,A2,A3,B1*,B2
	13	95	A1*,A2,A3,B1,B2	91	A1,A2,A3,B1*,B2
	14	100	A1,A2,A3,B1,B2	100	A1,A2,A3,B1,B2

*Unloaded compressor.

NOTE: These capacity control steps may vary due to lag compressor sequencing.

Table 5A — Part Load Data Percent Displacement, Standard Units (cont)

UNIT 30GTN,GTR	CONTROL STEPS	LOADING SEQUENCE A		LOADING SEQUENCE B	
		% Displacement (Approx)	Compressors	% Displacement (Approx)	Compressors
150, 230A, 245A, 255A (50 Hz)	1	13	A1*	13	B1*
	2	20	A1	20	B1
	3	26	A1*,B1*	26	A1*,B1*
	4	33	A1*,B1	33	A1,B1*
	5	40	A1,B1	40	A1,B1
	6	46	A1*,A2,B1*	46	A1*,B1*,B2
	7	53	A1*,A2,B1	53	A1,B1*,B2
	8	60	A1,A2,B1	60	A1,B1,B2
	9	66	A1*,A2,B1*,B2	66	A1*,A2,B1*,B2
	10	73	A1*,A2,B1,B2	73	A1,A2,B1*,B2
	11	80	A1,A2,B1,B2	80	A1,A2,B1,B2
	12	86	A1*,A2,A3,B1*,B2	86	A1*,A2,A3,B1*,B2
	13	93	A1*,A2,A3,B1,B2	93	A1,A2,A3,B1*,B2
	14	100	A1,A2,A3,B1,B2	100	A1,A2,A3,B1,B2
170, 270A, 330A/B (60 Hz)	1	11	A1*	11	B1*
	2	17	A1	17	B1
	3	23	A1*,B1*	23	A1*,B1*
	4	28	A1*,B1	28	A1,B1*
	5	33	A1,B1	33	A1,B1
	6	39	A1*,A2,B1*	39	A1*,B1*,B2
	7	45	A1*,A2,B1	45	A1,B1*,B2
	8	50	A1,A2,B1	50	A1,B1,B2
	9	56	A1*,A2,B1*,B2	56	A1*,A2,B1*,B2
	10	61	A1*,A2,B1,B2	61	A1,A2,B1*,B2
	11	67	A1,A2,B1,B2	67	A1,A2,B1,B2
	12	73	A1*,A2,A3,B1*,B2	73	A1*,A2,B1*,B2,B3
	13	78	A1*,A2,A3,B1,B2	78	A1,A2,B1*,B2,B3
	14	83	A1,A2,A3,B1,B2	83	A1,A2,B1,B2,B3
	15	89	A1*,A2,A3,B1*,B2,B3	89	A1*,A2,A3,B1*,B2,B3
	16	95	A1*,A2,A3,B1,B2,B3	95	A1,A2,A3,B1*,B2,B3
	17	100	A1,A2,A3,B1,B2,B3	100	A1,A2,A3,B1,B2,B3
170, 270A, 330A/B,360B (50 Hz)	1	9	A1*	9	B1*
	2	14	A1	14	B1
	3	19	A1*,B1*	19	A1*,B1*
	4	23	A1*,B1	23	A1,B1*
	5	28	A1,B1	28	A1,B1
	6	33	A1*,A2,B1*	38	A1*,B1*,B2
	7	37	A1*,A2,B1	43	A1,B1*,B2
	8	42	A1,A2,B1	47	A1,B1,B2
	9	52	A1*,A2,B1*,B2	52	A1*,A2,B1*,B2
	10	57	A1*,A2,B1,B2	57	A1,A2,B1*,B2
	11	61	A1,A2,B1,B2	61	A1,A2,B1,B2
	12	72	A1*,A2,A3,B1*,B2	72	A1*,A2,B1*,B2,B3
	13	76	A1*,A2,A3,B1,B2	76	A1,A2,B1*,B2,B3
	14	81	A1,A2,A3,B1,B2	81	A1,A2,B1,B2,B3
	15	91	A1*,A2,A3,B1*,B2,B3	91	A1*,A2,A3,B1*,B2,B3
	16	96	A1*,A2,A3,B1,B2,B3	96	A1,A2,A3,B1*,B2,B3
	17	100	A1,A2,A3,B1,B2,B3	100	A1,A2,A3,B1,B2,B3
190, 290A, 360A/B, 390B (60 Hz)	1	13	A1	13	B1
	2	25	A1,B1	25	A1,B1
	3	41	A1,A2,B1	41	A1,B1,B2
	4	56	A1,A2,B1,B2	56	A1,A2,B1,B2
	5	78	A1,A2,A3,B1,B2	78	A1,A2,B1,B2,B3
	6	100	A1,A2,A3,B1,B2,B3	100	A1,A2,A3,B1,B2,B3
190, 290A, 360A, 390B (50 Hz)	1	17	A1	17	B1
	2	33	A1,B1	33	A1,B1
	3	50	A1,A2,B1	50	A1,B1,B2
	4	67	A1,A2,B1,B2	67	A1,A2,B1,B2
	5	83	A1,A2,A3,B1,B2	83	A1,A2,B1,B2,B3
	6	100	A1,A2,A3,B1,B2,B3	100	A1,A2,A3,B1,B2,B3
210, 315A, 390A, 420A/B (60 Hz)	1	11	A1	14	B1
	2	25	A1,B1	25	A1,B1
	3	36	A1,A2,B1	44	A1,B1,B2
	4	56	A1,A2,B1,B2	56	A1,A2,B1,B2
	5	67	A1,A2,A3,B1,B2	75	A1,A2,B1,B2,B3
	6	86	A1,A2,A3,B1,B2,B3	86	A1,A2,A3,B1,B2,B3
	7	100	A1,A2,A3,A4,B1,B2,B3	100	A1,A2,A3,A4,B1,B2,B3
210, 315A, 390A, 420A/B (50 Hz)	1	9	A1	16	B1
	2	26	A1,B1	26	A1,B1
	3	35	A1,A2,B1	42	A1,B1,B2
	4	51	A1,A2,B1,B2	51	A1,A2,B1,B2
	5	67	A1,A2,A3,B1,B2	67	A1,A2,B1,B2,B3
	6	84	A1,A2,A3,B1,B2,B3	84	A1,A2,A3,B1,B2,B3
	7	100	A1,A2,A3,A4,B1,B2,B3	100	A1,A2,A3,A4,B1,B2,B3

*Unloaded compressor.

NOTE: These capacity control steps may vary due to lag compressor sequencing.

Table 5B — Part Load Data Percent Displacement, With Accessory Unloaders

UNIT 30GTN,GTR	CONTROL STEPS	LOADING SEQUENCE A		LOADING SEQUENCE B	
		% Displacement (Approx)	Compressors	% Displacement (Approx)	Compressors
040 (60 Hz)	1	25	A1*	25	B1*
	2	50	A1	50	B1
	3	75	A1*,B1	75	A1,B1*
	4	100	A1,B1	100	A1,B1
040 (50 Hz) 045 (60 Hz)	1	24	A1*	37	B1*
	2	47	A1	53	B1
	3	61	A1*,B1*	61	A1*,B1*
	4	76	A1*,B1	84	A1,B1*
	5	100	A1,B1	100	A1,B1
045 (50 Hz) 050 (60 Hz)	1	31	A1*	38	B1*
	2	44	A1	56	B1
	3	69	A1*,B1*	69	A1*,B1*
	4	87	A1*,B1	82	A1,B1*
	5	100	A1,B1	100	A1,B1
050 (50 Hz) 060 (60 Hz)	1	28	A1*	38	B1*
	2	42	A1	58	B1
	3	67	A1*,B1*	67	A1*,B1*
	4	87	A1*,B1	80	A1,B1*
	5	100	A1,B1	100	A1,B1
060 (50 Hz) 070 (60 Hz)	1	33	A1*	33	B1*
	2	50	A1	50	B1
	3	67	A1*,B1*	66	A1*,B1*
	4	83	A1*,B1	83	A1,B1*
	5	100	A1,B1	100	A1,B1
070 (50 Hz)	1	19	A1*	31	B1*
	2	27	A1	47	B1
	3	49	A1*,B1*	49	A1*,B1*
	4	65	A1*,B1	57	A1,B1*
	5	73	A1,B1	73	A1,B1
	6	76	A1*,A2,B1*	76	A1*,A2,B1*
	7	92	A1*,A2,B1	84	A1,A2,B1*
	8	100	A1,A2,B1	100	A1,A2,B1
080, 230B (60 Hz)	1	11	A1†	15	B1†
	2	22	A1*	30	B1*
	3	34	A1	44	B1
	4	41	A1†,B1*	48	A1,B1†
	5	55	A1†,B1	63	A1,B1*
	6	67	A1*,B1	78	A1,B1
	7	78	A1,B1	85	A1,A2,B1*
	8	89	A1*,A2,B1	100	A1,A2,B1
	9	100	A1,A2,B1	—	—
080, 230B (50 Hz)	1	8	A1†	13	B1†
	2	17	A1*	25	B1*
	3	25	A1	38	B1
	4	33	A1†,B1*	50	A1,B1*
	5	46	A1†,B1	62	A1,B1
	6	54	A1*,B1	67	A1*,A2,B1†
	7	62	A1,B1	75	A1,A2,B1†
	8	71	A1†,A2,B1*	88	A1,A2,B1*
	9	84	A1†,A2,B1	100	A1,A2,B1
	10	92	A1*,A2,B1	—	—
	11	100	A1,A2,B1	—	—
090, 245B (60 Hz)	1	9	A1†	9	B1†
	2	18	A1*	18	B1*
	3	27	A1	27	B1
	4	35	A1†,B1	35	A1,B1†
	5	44	A1*,B1	44	A1,B1*
	6	53	A1,B1	53	A1,B1
	7	56	A1†,A2,B1	62	A1,B1†,B2
	8	65	A1*,A2,B1	71	A1,B1* B2
	9	74	A1,A2,B1	80	A1,B1,B2
	10	82	A1†,A2,B1,B2	82	A1,A2,B1†,B2
	11	91	A1*,A2,B1,B2	91	A1,A2,B1* B2
	12	100	A1,A2,B1,B2	100	A1,A2,B1,B2

*Unloaded compressor.

†Two unloaders, both unloaded.

NOTE: These capacity control steps may vary due to lag compressor sequencing.

Table 5B — Part Load Data Percent Displacement, With Accessory Unloaders (cont)

UNIT 30GTN,GTR	CONTROL STEPS	LOADING SEQUENCE A		LOADING SEQUENCE B	
		% Displacement (Approx)	Compressors	% Displacement (Approx)	Compressors
090, 245B (50 Hz)	1	7	A1†	7	B1†
	2	14	A1*	14	B1*
	3	21	A1	21	B1
	4	29	A1†,B1	29	A1,B1†
	5	36	A1*,B1	36	A1,B1*
	6	43	A1,B1	43	A1,B1
	7	49	A1†,A2,B1†	46	A1*,B1†,B2
	8	54	A1†,A2,B1*	53	A1,B1†,B2
	9	61	A1†,A2,B1	60	A1,B1*,B2
	10	68	A1*,A2,B1	67	A1,B1,B2
	11	75	A1,A2,B1	72	A1†,A2,B1†,B2
	12	79	A1†,A2,B1*,B2	79	A1*,A2,B1†,B2
	13	86	A1†,A2,B1,B2	86	A1,A2,B1†,B2
	14	93	A1*,A2,B1,B2	93	A1,A2,B1*,B2
	15	100	A1,A2,B1,B2	100	A1,A2,B1,B2
100, 255B, 270B (60 Hz)	1	8	A1†	8	B1†
	2	16	A1*	16	B1*
	3	23	A1	23	B1
	4	31	A1†,B1	31	A1,B1†
	5	39	A1*,B1	39	A1,B1*
	6	46	A1,B1	46	A1,B1
	7	50	A1†,A2,B1*	50	A1*,B1†,B2
	8	58	A1†,A2,B1	58	A1,B1†,B2
	9	66	A1*,A2,B1	66	A1,B1*,B2
	10	73	A1,A2,B1	73	A1,B1,B2
	11	77	A1†,A2,B1*,B2	77	A1*,A2,B1†,B2
	12	85	A1†,A2,B1,B2	85	A1,A2,B1†,B2
	13	92	A1*,A2,B1,B2	92	A1,A2,B1*,B2
	14	100	A1,A2,B1,B2	100	A1,A2,B1,B2
100, 255B, 270B (50 Hz)	1	7	A1†	7	B1†
	2	13	A1*	13	B1*
	3	20	A1	20	B1
	4	26	A1†,B1	26	A1,B1†
	5	33	A1*,B1	33	A1,B1*
	6	40	A1,B1	40	A1,B1
	7	43	A1†,A2,B1†	43	A1†,B1†,B2
	8	50	A1†,A2,B1*	50	A1*,B1†,B2
	9	57	A1†,A2,B1	57	A1,B1†,B2
	10	63	A1*,A2,B1	63	A1,B1*,B2
	11	70	A1,A2,B1	70	A1,B1,B2
	12	74	A1†,A2,B1†,B2	74	A1†,A2,B1†,B2
	13	80	A1†,A2,B1*,B2	80	A1*,A2,B1†,B2
	14	89	A1†,A2,B1,B2	87	A1,A2,B1†,B2
	15	93	A1*,A2,B1,B2	93	A1,A2,B1*,B2
	16	100	A1,A2,B1,B2	100	A1,A2,B1,B2
110, 290B, 315B (60 Hz)	1	7	A1†	7	B1†
	2	14	A1*	14	B1*
	3	21	A1	21	B1
	4	29	A1†,B1	29	A1,B1†
	5	36	A1*,B1	36	A1,B1*
	6	43	A1,B1	43	A1,B1
	7	47	A1†,A2,B1†	46	A1*,B1†,B2
	8	54	A1†,A2,B1*	53	A1,B1†,B2
	9	61	A1†,A2,B1	60	A1,B1*,B2
	10	68	A1*,A2,B1	67	A1,B1,B2
	11	75	A1,A2,B1	72	A1†,A2,B1†,B2
	12	79	A1†,A2,B1*,B2	79	A1*,A2,B1†,B2
	13	86	A1†,A2,B1,B2	86	A1,A2,B1†,B2
	14	93	A1*,A2,B1,B2	93	A1,A2,B1*,B2
	15	100	A1,A2,B1,B2	100	A1,A2,B1,B2
110, 290B, 315B (50 Hz)	1	8	A1†	8	B1†
	2	17	A1*	17	B1*
	3	25	A1	25	B1
	4	33	A1†,B1	33	A1,B1†
	5	42	A1*,B1	42	A1,B1*
	6	50	A1,B1	50	A1,B1
	7	58	A1†,A2,B1	58	A1,B1†,B2
	8	67	A1*,A2,B1	67	A1,B1*,B2
	9	75	A1,A2,B1	75	A1,B1,B2
	10	83	A1†,A2,B1,B2	83	A1,A2,B1†,B2
	11	92	A1*,A2,B1,B2	92	A1,A2,B1*,B2
	12	100	A1,A2,B1,B2	100	A1,A2,B1,B2

*Unloaded compressor.

†Two unloaders, both unloaded.

NOTE: These capacity control steps may vary due to lag compressor sequencing.

Table 5B — Part Load Data Percent Displacement, with Accessory Unloaders (cont)

UNIT 30GTN,GTR	CONTROL STEPS	LOADING SEQUENCE A		LOADING SEQUENCE B	
		% Displacement (Approx)	Compressors	% Displacement (Approx)	Compressors
130 (60 Hz)	1	8	A1†	8	B1†
	2	14	A1*	14	B1*
	3	21	A1	21	B1
	4	22	A1†,B1*	22	A1*,B1†
	5	28	A1†,B1	28	A1,B1†
	6	35	A1*,B1	35	A1,B1*
	7	42	A1,B1	42	A1,B1
	8	44	A1†,A2,B1†	44	A1†,B1†,B2
	9	51	A1†,A2,B1*	51	A1*,B1†,B2
	10	58	A1†,A2,B1	58	A1,B1†,B2
	11	64	A1,A2,B1	64	A1,B1*,B2
	12	71	A1,A2,B1	71	A1,B1,B2
	13	73	A1†,A2,B1†,B2	73	A1†,A2,B1†,B2
	14	80	A1†,A2,B1*,B2	80	A1*,A2,B1†,B2
	15	87	A1†,A2,B1,B2	87	A1,A2,B1†,B2
	16	93	A1*,A2,B1,B2	93	A1,A2,B1*,B2
	17	100	A1,A2,B1,B2	100	A1,A2,B1,B2
130 (50 Hz)	1	6	A1†	8	B1†
	2	10	A1*	16	B1*
	3	14	A1	25	B1
	4	22	A1†,B1*	31	A1,B1*
	5	31	A1†,B1	39	A1,B1
	6	35	A1*,B1	43	A1*,B1†,B2
	7	39	A1,B1	47	A1,B1†,B2
	8	40	A1†,A2,B1*	56	A1,B1*,B2
	9	49	A1†,A2,B1	64	A1,B1,B2
	10	53	A1*,A2,B1	65	A1,A2,B1†,B2
	11	57	A1,A2,B1	74	A1,A2,B1*,B2
	12	65	A1†,A2,B1*,B2	82	A1,A2,B1,B2
	13	74	A1†,A2,B1,B2	83	A1,A2,A3,B1†,B2
	14	78	A1*,A2,B1,B2	91	A1,A2,A3,B1*,B2
	15	82	A1,A2,B1,B2	100	A1,A2,A3,B1,B2
	16	83	A1†,A2,A3,B1*,B2	—	—
	17	91	A1†,A2,A3,B1,B2	—	—
	18	96	A1*,A2,A3,B1,B2	—	—
	19	100	A1,A2,A3,B1,B2	—	—
150, 230A, 245A, 255A (60 Hz)	1	6	A1†	9	B1†
	2	11	A1*	18	B1*
	3	15	A1	27	B1
	4	24	A1†,B1*	33	A1,B1*
	5	33	A1†,B1	42	A1,B1
	6	38	A1*,B1	46	A1*,B1†,B2
	7	42	A1,B1	51	A1,B1†,B2
	8	49	A1†,A2,B1	60	A1,B1*,B2
	9	53	A1*,A2,B1	69	A1,B1,B2
	10	58	A1,A2,B1	75	A1,A2,B1*,B2
	11	66	A1†,A2,B1*,B2	86	A1,A2,B1,B2
	12	75	A1†,A2,B1,B2	91	A1,A2,A3,B1*,B2
	13	80	A1*,A2,B1,B2	100	A1,A2,A3,B1,B2
	14	85	A1,A2,B1,B2	—	—
	15	91	A1†,A2,A3,B1,B2	—	—
	16	95	A1*,A2,A3,B1,B2	—	—
	17	100	A1,A2,A3,B1,B2	—	—
150, 230A, 245A, 255A (50 Hz)	1	6	A1†	6	B1†
	2	13	A1	13	B1*
	3	20	*A1	20	B1
	4	26	A1†,B1	26	A1,B1†
	5	33	A1*,B1	33	A1,B1*
	6	40	A1,B1	40	A1,B1
	7	46	A1†,A2,B1	46	A1,B1†,B2
	8	53	A1*,A2,B1	53	A1,B1*,B2
	9	60	A1,A2,B1	60	A1,B1,B2
	10	66	A1†,A2,B1,B2	66	A1,A2,B1†,B2
	11	73	A1*,A2,B1,B2	73	A1,A2,B1*,B2
	12	80	A1,A2,B1,B2	80	A1,A2,B1,B2
	13	86	A1†,A2,A3,B1,B2	86	A1,A2,A3,B1†,B2
	14	93	A1*,A2,A3,B1,B2	93	A1,A2,A3,B1*,B2
	15	100	A1,A2,A3,B1,B2	100	A1,A2,A3,B1,B2

*Unloaded compressor.

†Two unloaders, both unloaded.

NOTE: These capacity control steps may vary due to lag compressor sequencing.

Table 5B — Part Load Data Percent Displacement, With Accessory Unloaders (cont)

UNIT 30GTN,GTR	CONTROL STEPS	LOADING SEQUENCE A		LOADING SEQUENCE B	
		% Displacement (Approx)	Compressors	% Displacement (Approx)	Compressors
170, 270A, 330A/B (60 Hz)	1	6	A1†	6	B1†
	2	11	A1*	11	B1*
	3	17	A1	17	B1
	4	17	A1†,B1*	17	A1*,B1†
	5	23	A1†,B1	23	A1,B1†
	6	28	A1*,B1	28	A1,B1*
	7	33	A1,B1	33	A1,B1
	8	34	A1†,A2,B1*	34	A1*,B1†,B2
	9	39	A1†,A2,B1	39	A1,B1†,B2
	10	45	A1*,A2,B1	45	A1,B1*,B2
	11	50	A1,A2,B1	50	A1,B1,B2
	12	51	A1†,A2,B1*,B2	51	A1*,A2,B1†,B2
	13	56	A1†,A2,B1,B2	56	A1,A2,B1†,B2
	14	61	A1*,A2,B1,B2	61	A1,A2,B1*,B2
	15	67	A1,A2,B1,B2	67	A1,A2,B1,B2
	16	67	A1†,A2,A3,B1*,B2	67	A1*,A2,B1†,B2,B3
	17	73	A1†,A2,A3,B1,B2	73	A1,A2,B1†,B2,B3
	18	78	A1*,A2,A3,B1,B2	78	A1,A2,B1*,B2,B3
	19	83	A1,A2,A3,B1,B2	83	A1,A2,B1,B2,B3
	20	84	A1†,A2,A3,B1*,B2,B3	84	A1*,A2,A3,B1†,B2,B3
	21	89	A1†,A2,A3,B1,B2,B3	89	A1,A2,A3,B1†,B2,B3
	22	95	A1*,A2,A3,B1,B2,B3	95	A1,A2,A3,B1*,B2,B3
	23	100	A1,A2,A3,B1,B2,B3	100	A1,A2,A3,B1,B2,B3
170, 270A, 330A/B, 360B (50 Hz)	1	5	A1†	5	B1†
	2	9	A1*	9	B1*
	3	14	A1	14	B1
	4	14	A1†,B1*	14	A1*,B1†
	5	19	A1†,B1	19	A1,B1†
	6	23	A1*,B1	23	A1,B1*
	7	28	A1,B1	28	A1,B1
	8	28	A1†,A2,B1*	29	A1†,B1†,B2
	9	33	A1†,A2,B1	34	A1*,B1†,B2
	10	37	A1*,A2,B1	38	A1,B1†,B2
	11	42	A1,A2,B1	43	A1,B1*,B2
	12	43	A1†,A2,B1†,B2	47	A1,B1,B2
	13	48	A1†,A2,B1*,B2	48	A1*,A2,B1†,B2
	14	52	A1†,A2,B1,B2	52	A1,A2,B1†,B2
	15	57	A1*,A2,B1,B2	57	A1,A2,B1*,B2
	16	61	A1,A2,B1,B2	61	A1,A2,B1,B2
	17	63	A1†,A2,A3,B1†,B2	63	A1†,A2,B1†,B2,B3
	18	67	A1†,A2,A3,B1*,B2	67	A1*,A2,B1†,B2,B3
	19	72	A1†,A2,A3,B1,B2	72	A1,A2,B1†,B2,B3
	20	76	A1*,A2,A3,B1,B2	76	A1,A2,B1*,B2,B3
	21	81	A1,A2,A3,B1,B2	81	A1,A2,B1,B2,B3
	22	82	A1†,A2,A3,B1†,B2,B3	82	A1†,A2,A3,B1†,B2,B3
	23	87	A1†,A2,A3,B1*,B2,B3	87	A1*,A2,A3,B1†,B2,B3
	24	91	A1†,A2,A3,B1,B2,B3	91	A1,A2,A3,B1†,B2,B3
	25	96	A1*,A2,A3,B1,B2,B3	96	A1,A2,A3,B1*,B2,B3
	26	100	A1,A2,A3,B1,B2,B3	100	A1,A2,A3,B1,B2,B3
190, 290A, 360A/B, 390B (60 Hz)	1	9	A1*	9	B1*
	2	13	A1	13	B1
	3	18	A1*,B1*	18	A1*,B1*
	4	21	A1*,B1	21	A1,B1*
	5	25	A1,B1	25	A1,B1
	6	33	A1*,A2,B1*	33	A1*,B1*,B2
	7	37	A1*,A2,B1	37	A1,B1*,B2
	8	41	A1,A2,B1	41	A1,B1,B2
	9	49	A1*,A2,B1*,B2	49	A1*,A2,B1*,B2
	10	53	A1*,A2,B1,B2	53	A1,A2,B1*,B2
	11	56	A1,A2,B1,B2	56	A1,A2,B1,B2
	12	71	A1*,A2,A3,B1*,B2	71	A1*,A2,B1*,B2,B3
	13	74	A1*,A2,A3,B1,B2	74	A1,A2,B1*,B2,B3
	14	78	A1,A2,A3,B1,B2	78	A1,A2,B1,B2,B3
	15	93	A1*,A2,A3,B1*,B2,B3	93	A1*,A2,A3,B1*,B2,B3
	16	96	A1*,A2,A3,B1,B2,B3	96	A1,A2,A3,B1*,B2,B3
	17	100	A1,A2,A3,B1,B2,B3	100	A1,A2,A3,B1,B2,B3

*Unloaded compressor.

†Two unloaders, both unloaded.

NOTE: These capacity control steps may vary due to lag compressor sequencing.

Table 5B — Part Load Data Percent Displacement, With Accessory Unloaders (cont)

UNIT 30GTN,GTR	CONTROL STEPS	LOADING SEQUENCE A		LOADING SEQUENCE B	
		% Displacement (Approx)	Compressors	% Displacement (Approx)	Compressors
190, 290A, 360A, 390B (50 Hz)	1	11	A1*	11	B1*
	2	17	A1	17	B1
	3	22	A1*,B1*	22	A1*,B1*
	4	28	A1*,B1	28	A1,B1*
	5	33	A1,B1	33	A1,B1
	6	39	A1*,A2,B1*	39	A1*,B1*,B2
	7	44	A1*,A2,B1	44	A1,B1*,B2
	8	50	A1,A2,B1	50	A1,B1,B2
	9	55	A1*,A2,B1*,B2	55	A1*,A2,B1*,B2
	10	61	A1*,A2,B1,B2	61	A1,A2,B1*,B2
	11	67	A1,A2,B1,B2	67	A1,A2,B1,B2
	12	72	A1*,A2,A3,B1*,B2	72	A1*,A2,B1*,B2,B3
	13	78	A1*,A2,A3,B1,B2	78	A1,A2,B1*,B2,B3
	14	83	A1,A2,A3,B1,B2	83	A1,A2,B1,B2,B3
	15	89	A1*,A2,A3,B1*,B2,B3	89	A1*,A2,A3,B1*,B2,B3
	16	94	A1*,A2,A3,B1,B2,B3	94	A1,A2,A3,B1*,B2,B3
	17	100	A1,A2,A3,B1,B2,B3	100	A1,A2,A3,B1,B2,B3
210, 315A, 390A, 420A/B (60 Hz)	1	8	A1*	9	B1*
	2	11	A1	14	B1
	3	17	A1*,B1*	17	A1*,B1*
	4	22	A1*,B1	21	A1,B1*
	5	25	A1,B1	25	A1,B1
	6	28	A1*,A2,B1*	37	A1*,B1*,B2
	7	33	A1*,A2,B1	40	A1,B1*,B2
	8	36	A1,A2,B1	44	A1,B1,B2
	9	48	A1*,A2,B1*,B2	48	A1*,A2,B1*,B2
	10	52	A1*,A2,B1,B2	51	A1,A2,B1*,B2
	11	56	A1,A2,B1,B2	56	A1,A2,B1,B2
	12	59	A1*,A2,A3,B1*,B2	67	A1*,A2,B1*,B2,B3
	13	63	A1*,A2,A3,B1,B2	71	A1,A2,B1*,B2,B3
	14	67	A1,A2,A3,B1,B2	75	A1,A2,B1,B2,B3
	15	78	A1*,A2,A3,B1*,B2,B3	78	A1*,A2,A3,B1*,B2,B3
	16	83	A1*,A2,A3,B1,B2,B3	82	A1,A2,A3,B1*,B2,B3
	17	86	A1,A2,A3,B1,B2,B3	86	A1,A2,A3,B1,B2,B3
	18	92	A1*,A2,A3,A4,B1*,B2,B3	92	A1*,A2,A3,A4,B1*,B2,B3
	19	97	A1*,A2,A3,A4,B1,B2,B3	96	A1,A2,A3,A4,B1*,B2,B3
	20	100	A1,A2,A3,A4,B1,B2,B3	100	A1,A2,A3,A4,B1,B2,B3
210, 315A, 390A, 420A/B (50 Hz)	1	7	A1*	11	B1*
	2	9	A1	16	B1
	3	17	A1*,B1*	17	A1*,B1*
	4	23	A1*,B1	20	A1,B1*
	5	26	A1,B1	26	A1,B1
	6	27	A1*,A2,B1*	34	A1*,B1*,B2
	7	32	A1*,A2,B1	36	A1,B1*,B2
	8	35	A1,A2,B1	42	A1,B1,B2
	9	43	A1*,A2,B1*,B2	43	A1*,A2,B1*,B2
	10	48	A1*,A2,B1,B2	46	A1,A2,B1*,B2
	11	51	A1,A2,B1,B2	51	A1,A2,B1,B2
	12	59	A1*,A2,A3,B1*,B2	59	A1*,A2,B1*,B2,B3
	13	65	A1*,A2,A3,B1,B2	62	A1,A2,B1*,B2,B3
	14	67	A1,A2,A3,B1,B2	67	A1,A2,B1,B2,B3
	15	75	A1*,A2,A3,B1*,B2,B3	75	A1*,A2,A3,B1*,B2,B3
	16	81	A1*,A2,A3,B1,B2,B3	78	A1,A2,A3,B1*,B2,B3
	17	84	A1,A2,A3,B1,B2,B3	84	A1,A2,A3,B1,B2,B3
	18	92	A1*,A2,A3,A4,B1*,B2,B3	92	A1*,A2,A3,A4,B1*,B2,B3
	19	97	A1*,A2,A3,A4,B1,B2,B3	94	A1,A2,A3,A4,B1*,B2,B3
	20	100	A1,A2,A3,A4,B1,B2,B3	100	A1,A2,A3,A4,B1,B2,B3

*Unloaded compressor.

†Two unloaders, both unloaded.

NOTE: These capacity control steps may vary due to lag compressor sequencing.

MINUTES LEFT FOR START — This value is displayed only in the network display tables (i.e., Service Tool, Comfortworks®) and represents the amount of time to elapse before the unit will start its initialization routine. This value can be zero without the machine running in many situations. This can include being unoccupied, ENABLE/OFF/REMOTE CONTACT switch in the OFF position, CCN not allowing unit to start, Demand Limit in effect, no call for cooling due to no load, and alarm or alert conditions present. If the machine should be running and none of the above are true, a minimum off time (DELY, see below) may be in effect. The machine should start normally once the time limit has expired.

MINUTES OFF TIME (DELY, Configuration Mode under OPT2) — This user configurable time period is used by the control to determine how long unit operation is delayed after power is applied/restored to the unit. It is also used to delay compressor restarts after the unit has shut off its lowest stage of capacity. Typically, this time period is configured when multiple machines are located on a single site. For example, this gives the user the ability to prevent all the units from restarting at once after a power failure. A value of zero for this variable does not mean that the unit should be running.

LOADING SEQUENCE — The 30GTN,R compressor efficiency is greatest at partial load. Therefore, the following sequence list applies to capacity control.

1. The next compressor will be started with unloaders energized on both lead compressors.
2. All valid capacity combinations using unloaders will be used as long as the total capacity is increasing.

LEAD/LAG DETERMINATION (LLCS, Configuration Mode under OPT2) — This is a configurable choice and is factory set to be automatic (for sizes 080-420) or Circuit A leading (for 040-070 sizes). For 040-070 sizes, the value can be changed to Automatic or Circuit B only if an accessory unloader is added to compressor B1. For 080-420 sizes, the value can be changed to Circuit A or Circuit B leading, as desired. Set at automatic, the control will sum the current number of logged circuit starts and one-quarter of the current operating hours for each circuit. The circuit with the lowest sum is started first. Changes to which circuit is the lead circuit and which is the lag are also made when total machine capacity is at 100% or when there is a change in the direction of capacity (increase or decrease) and each circuit's capacity is equal.

CAPACITY SEQUENCE DETERMINATION (LOAD, Configuration Mode under OPT2) — This is configurable as equal circuit loading or staged circuit loading with the default set at equal. The control determines the order in which the steps of capacity for each circuit are changed. This control choice does NOT have any impact on machines with only 2 compressors.

CAPACITY CONTROL OVERRIDES — The following overrides will modify the normal operation of the routine.

Deadband Multiplier — The user configurable Deadband Multiplier (Z.GN, Configuration Mode under SLCT) has a default value of 1.0. The range is from 1.0 to 4.0. When set to other than 1.0, this factor is applied to the capacity Load/Unload Factor. The larger this value is set, the longer the control will delay between adding or removing stages of

capacity. Figure 16 shows how compressor starts can be reduced over time if the leaving water temperature is allowed to drift a larger amount above and below the set point. This value should be set in the range of 3.0 to 4.0 for systems with small loop volumes.

First Stage Override — If the current capacity stage is zero, the control will modify the routine with a 1.2 factor on adding the first stage to reduce cycling. This factor is also applied when the control is attempting to remove the last stage of capacity.

Slow Change Override — The control prevents the capacity stages from being changed when the leaving fluid temperature is close to the set point (within an adjustable deadband) and moving towards the set point.

Ramp Loading (CRMP, Configuration Mode under SLCT) — Limits the rate of change of leaving fluid temperature. If the unit is in a Cooling mode and configured for Ramp Loading, the control makes 2 comparisons before deciding to change stages of capacity. The control calculates a temperature difference between the control point and leaving fluid temperature. If the difference is greater than 4° F (2.2° C) and the rate of change (°F or °C per minute) is more than the configured Cooling Ramp Loading value (CRMP), the control does not allow any changes to the current stage of capacity.

Low Entering Fluid Temperature Unloading — When the entering fluid temperature is below the control point, the control will attempt to remove 25% of the current stages being used. If exactly 25% cannot be removed, the control removes an amount greater than 25%, but no more than necessary. The lowest stage will not be removed.

Low Cooler Suction Temperature — To avoid freezing the cooler, the control will compare the circuit Cooler Suction temperature (T5/T6) with a predetermined freeze point. For water circuits, the freeze point is 34 F (1.1 C). For brine circuits, the freeze point is 8° F (4.4° C) below the cooling set point (lower of 2 cooling set points for dual configuration). If the cooler suction temperature is below the freeze point, the unit capacity may not be allowed to increase. If the Cooler Suction temperature falls 24 to 29° F (13.3 to 16.1° C) below the freeze point minus 2.0 F (1.1 C) for 5 minutes, Mode 7 (Circuit A) or Mode 8 (Circuit B) is initiated and no additional lag compressor stages will be added. If the Cooler Suction temperature falls 30° F (16.7° C) or more below the freeze point minus 2.0 F (1.1 C) for 10 minutes, the circuit will shut down.

Cooler Freeze Protection — The control will try to prevent shutting the chiller down on a Cooler Freeze Protection alarm by removing stages of capacity. The control uses the same freeze point logic as described in the Low Cooler Suction Temperature section above. If the cooler leaving fluid temperature is less than the freeze point plus 2.0 F (1.1 C), the control will immediately remove one stage of capacity. This can be repeated once every 30 seconds.

MOP (Maximum Operating Pressure) Override — The control monitors saturated condensing and suction temperature for each circuit. Based on a maximum operating set point (saturated suction temperature), the control may lower the EXV position when system pressures approach the set parameters.

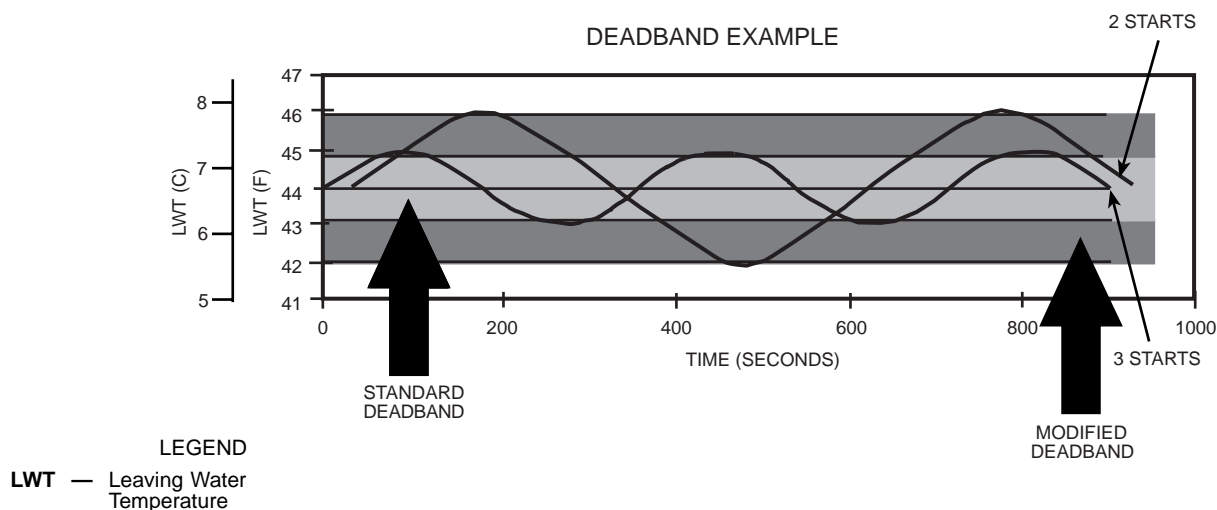


Fig. 16 — Deadband Multiplier

Head Pressure Control

COMFORTLINK™ UNITS (With EXV) — The Main Base Board (MBB) controls the condenser fans to maintain the lowest condensing temperature possible, and thus the highest unit efficiency. The fans are controlled by the saturated condensing temperature set from the factory. The fans can also be controlled by a combination of the saturated condensing temperature, EXV position and compressor superheat. Fan control is a configurable decision and is determined by the Head Pressure Control Method (HPCM) setting in the Configuration Mode under the OPT1 sub-mode. For EXV control (HPCM = 2), when the position of the EXV is fully open, T3 and T4 are less than 78 F (25.6 C), and superheat is greater than 40 F (22.2 C), fan stages will be removed. When the valve is less than 40% open, or T3 and T4 are greater than 113 F (45 C), fan stages will be added. At each change of the fan stage, the system will wait one minute to allow the head pressure to stabilize unless either T3 or T4 is greater than 125 F (51.6 C), in which case all MBB-controlled fans will start immediately. This method allows the unit to run at very low condensing temperatures at part load.

During the first 10 minutes after circuit start-up, MBB-controlled fans are not turned on until T3 and T4 are greater than the head pressure set point plus 10 F (5.6 C). If T3 and T4 are greater than 95 F (35 C) just prior to circuit start-up, all MBB-controlled fan stages are turned on to prevent excessive discharge pressure during pull-down. Fan sequences are shown in Fig. 17.

UNITS WITH TXV — The logic to cycle MBB-controlled fans is based on saturated condensing temperature only, as sensed by thermistors T3 and T4 (see Fig. 8 and 10). When either T3 or T4 exceeds the head pressure set point, the MBB will turn on an additional stage of fans. For the first 10 minutes of each circuit operation, the head pressure set point is raised by 10° F (5.6° C). It will turn off a fan stage when T3 and T4 are both below the head pressure set point by 35° F (19.4° C). At each change of a fan stage the control will wait for one minute for head pressure to stabilize unless T3 and

T4 is greater than 125 F (51.6 C), in which case all MBB-controlled fans start immediately. If T3 and T4 are greater than 95 F (35.0 C) just prior to circuit start-up, all MBB-controlled fan stages are turned on to prevent excessive discharge pressure during pull-down. Fan sequences are shown in Fig. 17.

Motormaster® Option — For low-ambient operation, the lead fan(s) in each circuit can be equipped with the Motormaster III head pressure controller option or accessory. Wind baffles and brackets must be field-fabricated for all units using accessory Motormaster III controls to ensure proper cooling cycle operation at low-ambient temperatures. The fans controlled are those that are energized with the lead compressor in each circuit. All sizes use one controller per circuit. Refer to Fig. 17 for condenser fan staging information.

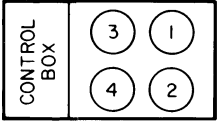
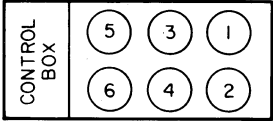
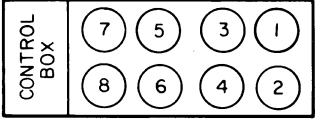
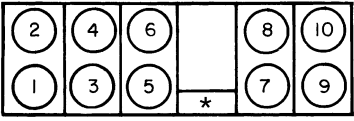
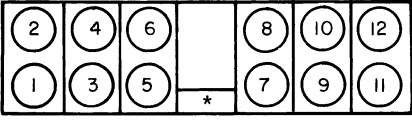
Pumpout

EXV UNITS — When the lead compressor in each circuit is started or stopped, that circuit goes through a pumpout cycle to purge the cooler and refrigerant suction lines of refrigerant. If a circuit is starting within 15 minutes of the last shutdown, the pumpout cycle will be skipped.

The pumpout cycle starts immediately upon starting the lead compressor and keeps the EXV at minimum position for 10 seconds. The EXV is then opened an additional percentage and compressor superheat control begins. At this point, the EXV opens gradually to provide a controlled start-up to prevent liquid flood-back to the compressor.

At shutdown, the pumpout cycle continuously closes the EXV until all lag compressors are off and the EXV is at 0%. The lead compressor continues to run for an additional 10 seconds and is then shut off.

TXV UNITS — Pumpout is based on timed pumpout. On a command for start-up, the lead compressor starts. After 15 seconds, the liquid line solenoid opens. At shutdown, the liquid line solenoid closes when the lead compressor has stopped.

FAN ARRANGEMENT	FAN NO.	FAN RELAY	NORMAL CONTROL
30GTN,R040-050 	1	—	Compressor No. A1
	2	—	Compressor No. B1
	3	A1	First Stage of Condenser Fans
	4	B1	Second Stage of Condenser Fans
30GTN,R060-090, 230B, 245B 	1	—	Compressor No. A1
	2	—	Compressor No. B1
	3, 4	A1	First Stage of Condenser Fans
	5, 6	B1	Second Stage of Condenser Fans
30GTN,R100,110, 255B-315B 	1	—	Compressor No. A1
	2	—	Compressor No. B1
	3, 4	A1	First Stage of Condenser Fans
	5, 6, 7, 8	B1	Second Stage of Condenser Fans
30GTN,R130 (60 Hz) POWER 	5, 7	—	Compressor No. A1
	6, 8	—	Compressor No. B1
	1, 2	A1	First Stage of Condenser Fans
	3, 4, 9, 10	B1	Second Stage of Condenser Fans
30GTN,R130 (50 Hz), 150-210, 230A-315A, 330A/B-420A/B† POWER 	5, 7	—	Compressor No. A1
	6, 8	—	Compressor No. B1
	1, 11	A1	First Stage of Condenser Fans, Circuit A
	3, 9	A2	Second Stage of Condenser Fans, Circuit A
	2, 12	B1	First Stage of Condenser Fans, Circuit B
	4, 10	B2	Second Stage of Condenser Fans, Circuit B

*Control box.

†Fan numbers 11 and 12 do not apply to 30GT130-170 and associated modular units (see Table 1).

Fig. 17 — Condenser Fan Sequence

Marquee Display Usage (See Fig. 18 and Tables 6-24) — The Marquee display module provides the user interface to the *ComfortLink™* control system. The display has up and down arrow keys, an **ESCAPE** key, and an **ENTER** key. These keys are used to navigate through the different levels of the display structure. See Table 6. Press the **ESCAPE** key until the display is blank to move through the top 11 mode levels indicated by LEDs on the left side of the display.

Pressing the **ESCAPE** and **ENTER** keys simultaneously will scroll a clear language text description across the display indicating the full meaning of each display acronym. Pressing the **ESCAPE** and **ENTER** keys when the display is blank (Mode LED level) will return the Marquee display to its default menu of rotating display items. In addition, the password will be disabled requiring that it be entered again before changes can be made to password protected items.

Clear language descriptions in English, Spanish, French, or Portuguese can be displayed when properly configuring the LANG variable in the Configuration Mode, under DISP submode. See Table 15.

NOTE: When the LANG variable is changed to 1, 2, or 3, all appropriate display expansions will immediately change to the new language. No power-off or control reset is required when reconfiguring languages.

When a specific item is located, the display will flash showing the operator, the item, followed by the item value and then followed by the item units (if any). Press the **ENTER** key to stop the display at the item value. Items in the Configuration and Service Test modes are password protected. The display will flash PASS and WORD when required. Use the **ENTER** and arrow keys to enter the 4 digits of the password. The default password is 1111. The password can only be changed through CCN devices such as ComfortWorks and Service Tool.

Changing item values or testing outputs is accomplished in the same manner. Locate and display the desired item. Press **ENTER** to stop the display at the item value. Press the **ENTER** key again so that the item value flashes. Use the arrow keys to change the value or state of an item and press the **ENTER** key to accept it. Press the **ESCAPE** key and the item, value, or units display will resume. Repeat the process as required for other items.

See Tables 6-24 for further details.

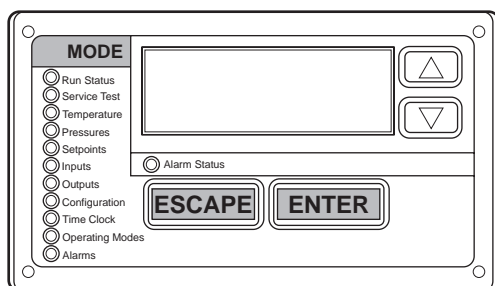



Fig. 18 — Scrolling Marquee Display

Service Test (See Table 8) — *Both main power and control circuit power must be on.*

The Service Test function should be used to verify proper operation of compressors, unloaders, hot gas bypass (if installed), cooler pump and remote alarm relays, EXVs and condenser fans. To use the Service Test mode, the Enable/Off/Remote Contact switch must be in the OFF position. Use the display keys and Table 8 to enter the mode and display TEST. Press **ENTER** twice so that OFF flashes, Enter the password if required. Use either arrow key to change the TEST value to the On position and press **ENTER**. Press **ESCAPE** and the  button to enter the OUTS or COMP sub-mode.

Test the condenser fan, cooler pump, and alarm relays by changing the item values from OFF to ON. These discrete outputs are turned off if there is no keypad activity for 10 minutes. Use arrow keys to select desired percentage when testing expansion valves. When testing compressors, the lead compressor must be started first. All compressor outputs can be turned on, but the control will limit the rate by staging one compressor per minute. Compressor unloaders and hot gas bypass relays/solenoids (if installed) can be tested with compressors on or off. The relays under the COMP sub-mode will stay on for 10 minutes if there is no keypad activity. Compressors will stay on until they are turned off by the operator. The Service Test mode will remain enabled for as long as there is one or more compressors running. All safeties are monitored during this test and will turn a compressor, circuit or the machine off if required. Any other mode or sub-mode can be accessed, viewed, or changed during the TEST mode. The MODE item (Run/status mode under sub-mode VIEW) will display “0” as long as the Service mode is enabled. The TEST sub-mode value must be changed back to OFF before the chiller can be switched to Enable or Remote contact for normal operation.

Configuring and Operating Dual Chiller Control (See Table 17) — The dual chiller routine is available for the control of two units supplying chilled fluid on a common loop. This control is designed for a parallel fluid flow arrangement only. One chiller must be configured as the Master, the other chiller as the Slave. The Master chiller Leaving Fluid Temperature thermistor (T1) must be installed in the common leaving chilled water line after the piping has joined from both chillers. See Fig. 19 for thermistor location.

To configure the two chillers for operation, follow the example shown in Table 17. The Master chiller will be configured with a slave at address 6. Also in this example, the Master will be configured to use Lead/Lag Balance to even out the chiller runtimes weekly. The Lag Start Delay feature will be set to 10 minutes. The Master and Slave chillers cannot have the same CCN address (CCNA, Configuration mode under OPT2). Both chillers must have the control method variable (CTRL, Configuration mode under OPT2) set to ‘3.’ In addition, the chillers must both be connected together on the same CCN bus. Connections can be made to the CCN screw terminals on TB3 in both chillers. The Master chiller will determine which chiller will be Lead and which will be Lag. The Master controls the Slave by forcing the Slave’s CHIL_S_S (CCN) variable, control point (CTPT) and demand limit.

The Master chiller is now configured for dual chiller operation. To configure the Slave chiller, only the LLEN and MSSL variables need to be set. Enable the Lead/Lag chiller enable variable (LLEN) as shown Table 17. Similarly, set the Master/Slave Select variable (MSSL) to SLVE. The variables LLBL, LLBD, an LLDY are not used by the Slave chiller.

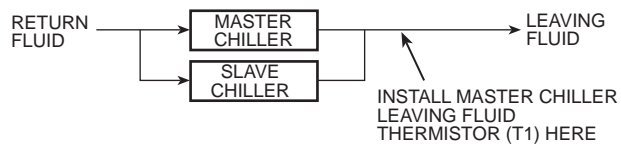


Fig. 19 — Dual Chiller Thermistor Location

Table 6 — Marquee Display Menu Structure)

RUN STATUS	SERVICE TEST	TEMPERATURES	PRESSURES	SET POINTS	INPUTS	OUTPUTS	CONFIGURATION	TIME CLOCK	OPERATING MODES	ALARMS
Auto Display (VIEW)	Manual Mode On/Off (TEST)	Unit Temperatures (UNIT)	Ckt A Pressures (PRC.A)	Cooling (COOL)	Unit Discrete (GEN.I)	Unit Discrete (GEN.O)	Display (DISP)	Unit Time (TIME)	Modes (MODE)	Current (CRNT)
Machine Hours/Starts (RUN)	Ckt A/B Outputs (OUTS)	Ckt A Temperatures (CIR.A)	Ckt B Pressures (PRC.B)	Head Pressure (HEAD)	Ckt A/B (CRCT)	Ckt A (CIR.A)	Machine (UNIT)	Unit Date (DATE)		Reset Alarms (RCRN)
Compressor Run Hours (HOUR)	Compressor Tests (COMP)	Ckt B Temperatures (CIR.B)			Unit Analog (4-20)	Ckt B (CIR.B)	Options 1 (OPT1)	Schedule (SCHD)		Alarm History (HIST)
Compressor Starts (STRT)							Options 2 (OPT2)			Reset History (RHIS)
							Temperature Reset (RSET)			
							Set Point Select (SLCT)			

LEGEND

Ckt — Circuit

Table 7 — Run Status Mode and Sub-Mode Directory
























































SUB-MODE	KEYPAD ENTRY	ITEM	DISPLAY	ITEM EXPANSION	COMMENT
VIEW		EWT	XXX.X °F	ENTERING FLUID TEMP	
		LWT	XXX.X °F	LEAVING FLUID TEMP	
		SETP	XXX.X °F	ACTIVE SETPOINT	
		CTPT	XXX.X °F	CONTROL POINT	
		MODE	X	CONTROL MODE	0 = SERVICE TEST 1 = OFF — LOCAL 2 = OFF — CCN 3 = OFF — TIME 4 = OFF — EMRGY 5 = ON — LOCAL 6 = ON — CCN 7 = ON — TIME
		OCC	YES/NO	OCCUPIED	
		CAP	XXX %	PERCENT TOTAL CAPACITY	
		STGE	XX	REQUESTED STAGE	
		ALRM	XX	CURRENT ALARMS & ALERTS	
		TIME	XX.XX	TIME OF DAY	00.0 — 23.59
		MNTH	XX	MONTH OF YEAR	1=JAN,2=FEB, etc.
		DATE	XX	DAY OF MONTH	01 — 31
		YEAR	XXXX	YEAR OF CENTURY	
RUN		HRS.U	XXXX	MACHINE OPERATING HOURS	
		STR.U	XXXX	MACHINE STARTS	
HOUR		HRS.A	XXXX	CIRCUIT A RUN HOURS	
		HRS.B	XXXX	CIRCUIT B RUN HOURS	
		HR.A1	XXXX	COMPRESSOR A1 RUN HOURS	
		HR.A2	XXXX	COMPRESSOR A2 RUN HOURS	
		HR.A3	XXXX	COMPRESSOR A3 RUN HOURS	
		HR.A4	XXXX	COMPRESSOR A4 RUN HOURS	
		HR.B1	XXXX	COMPRESSOR B1 RUN HOURS	
		HR.B2	XXXX	COMPRESSOR B2 RUN HOURS	
		HR.B3	XXXX	COMPRESSOR B3 RUN HOURS	
		HR.B4	XXXX	COMPRESSOR B4 RUN HOURS	
STRT		ST.A1	XXXX	COMPRESSOR A1 STARTS	
		ST.A2	XXXX	COMPRESSOR A2 STARTS	
		ST.A3	XXXX	COMPRESSOR A3 STARTS	
		ST.A4	XXXX	COMPRESSOR A4 STARTS	
		ST.B1	XXXX	COMPRESSOR B1 STARTS	
		ST.B2	XXXX	COMPRESSOR B2 STARTS	
		ST.B3	XXXX	COMPRESSOR B3 STARTS	
		ST.B4	XXXX	COMPRESSOR B4 STARTS	

Table 8 — Service Test Mode and Sub-Mode Directory

SUB-MODE	KEYPAD ENTRY	ITEM	DISPLAY	ITEM EXPANSION	COMMENT
TEST			ON/OFF	SERVICE TEST MODE	Use to Enable/Disable Manual Mode
OUTS		FR.A1	ON/OFF	FAN A1 RELAY	Fan 3 (040-050) Fans 3,4 (060-110, 230B-315B) Fans 1,2 (130 [60 Hz]) Fan 1 (130 [50 Hz], 150, 170, 230A- 270A, 330A/B, 360B [50 Hz]) Fans 1,11 (190-210, 290A, 315A, 360A, 360B [60 Hz], 390A/B-420A/B)
		FR.A2	ON/OFF	FAN A2 RELAY	Fans 3,9 (130 [50 Hz], 150-210, 230A-315A, 330A/B-420A/B)
		EXV.A	0-100%	EXV % OPEN	
		FR.B1	ON/OFF	FAN B1 RELAY	Fan 4 (040-050) Fans 5,6 (060-090, 230B-245B) Fans 5,6,7,8 (100,110, 255B-315B) Fans 3,4,9,10 (130 [60 Hz]) Fan 2 (130 [50 Hz], 150, 170, 230A- 270A, 330A/B, 360B [50 Hz]) Fans 2,12 (190-210,290A,315A, 360A, 360B [60 Hz], 390A/B-420A/B)
		FR.B2	ON/OFF	FAN B2 RELAY	Fans 4,10 (130 [50 Hz], 150-210, 230A-315A, 330A/B-420A/B)
		EXV.B	0-100%	EXV % OPEN	
		CLR.P	ON/OFF	COOLER PUMP RELAY	
		RMT.A	ON/OFF	REMOTE ALARM RELAY	
		CC.A1	ON/OFF	COMPRESSOR A1 RELAY	
		CC.A2	ON/OFF	COMPRESSOR A2 RELAY	
COMP		CC.A3	ON/OFF	COMPRESSOR A3 RELAY	
		CC.A4	ON/OFF	COMPRESSOR A4 RELAY	
		UL.A1	ON/OFF	UNLOADER A1 RELAY	
		UL.A2	ON/OFF	UNLOADER A2 RELAY	
		HGBP	ON/OFF	HOT GAS BYPASS RELAY	
		CC.B1	ON/OFF	COMPRESSOR B1 RELAY	
		CC.B2	ON/OFF	COMPRESSOR B2 RELAY	
		CC.B3	ON/OFF	COMPRESSOR B3 RELAY	
		CC.B4	ON/OFF	COMPRESSOR B4 RELAY	
		UL.B1	ON/OFF	UNLOADER B1 RELAY	
		UL.B2	ON/OFF	UNLOADER B2 RELAY	

LEGEND

EXV — Electronic Expansion Valve

Table 9 — Temperature Mode and Sub-Mode Directory













SUB-MODE	KEYPAD ENTRY	ITEM	DISPLAY	ITEM EXPANSION	COMMENT
UNIT		CEWT	XXX.X °F	COOLER ENTERING FLUID	
		CLWT	XXX.X °F	COOLER LEAVING FLUID	
		OAT	XXX.X °F	OUTSIDE AIR TEMPERATURE	
		SPT	XXX.X °F	SPACE TEMPERATURE	
CIR.A		SCT.A	XXX.X °F	SATURATED CONDENSING TMP	
		SST.A	XXX.X °F	SATURATED SUCTION TEMP	
		SGT.A	XXX.X °F	COMPRESSOR SUCTION TEMP	
		SUP.A	XXX.X °F	SUCTION SUPERHEAT TEMP	
CIR.B		SCT.B	XXX.X °F	SATURATED CONDENSING TMP	
		SST.B	XXX.X °F	SATURATED SUCTION TEMP	
		SGT.B	XXX.X °F	COMPRESSOR SUCTION TEMP	
		SUP.B	XXX.X °F	SUCTION SUPERHEAT TEMP	

Table 10 — Pressure Mode and Sub-Mode Directory





SUB-MODE	KEYPAD ENTRY	ITEM	DISPLAY	ITEM EXPANSION	COMMENT
PRC.A		DP.A	XXX.X PSIG	DISCHARGE PRESSURE	
		SP.A	XXX.X PSIG	SUCTION PRESSURE	
PRC.B		DP.B	XXX.X PSIG	DISCHARGE PRESSURE	
		SP.B	XXX.X PSIG	SUCTION PRESSURE	

Table 11 — Set Point Mode and Sub-Mode Directory





SUB-MODE	KEYPAD ENTRY	ITEM	DISPLAY	ITEM EXPANSION	COMMENT
COOL		CSP.1	XXX.X °F	COOLING SETPOINT 1	Default: 44 F
		CSP.2	XXX.X °F	COOLING SETPOINT 2	Default: 44 F
HEAD		HD.P.A	XXX °F	HEAD PRESSURE SETPOINT A	Default: 113 F
		HD.P.B	XXX °F	HEAD PRESSURE SETPOINT B	Default: 113 F

Table 12 — Reading and Changing Chilled Fluid Set Point







SUB-MODE	KEYPAD ENTRY	ITEM	DISPLAY	ITEM EXPANSION	COMMENT
COOL		CSP.1	44.0 °F	COOLING SETPOINT 1	Default: 44° F
			44.0 °F		Scrolling stops
			44.0 °F		Value flashes
					Select 46.0
			46.0 °F		Change accepted
		CSP.1	46.0 °F	COOLING SETPOINT 1	Item/Value/Units scrolls again

Table 13 — Inputs Mode and Sub-Mode Directory




















SUB-MODE	KEYPAD ENTRY	ITEM	DISPLAY	ITEM EXPANSION	COMMENT
GEN.I		STST	STRT/STOP	START/STOP SWITCH	Enable/Off/Remote Contact Switch Input
		FLOW	ON/OFF	COOLER FLOW SWITCH	
		DLS1	ON/OFF	DEMAND LIMIT SWITCH 1	
		DLS2	ON/OFF	DEMAND LIMIT SWITCH 2	
		ICED	ON/OFF	ICE DONE	
		DUAL	ON/OFF	DUAL SETPOINT SWITCH	
CRCT		FKA1	ON/OFF	COMPRESSOR A1 FEEDBACK	
		FKA2	ON/OFF	COMPRESSOR A2 FEEDBACK	
		FKA3	ON/OFF	COMPRESSOR A3 FEEDBACK	
		FKA4	ON/OFF	COMPRESSOR A4 FEEDBACK	
		OIL.A	OPEN/CLSE	OIL PRESSURE SWITCH A	
		FKB1	ON/OFF	COMPRESSOR B1 FEEDBACK	
		FKB2	ON/OFF	COMPRESSOR B2 FEEDBACK	
		FKB3	ON/OFF	COMPRESSOR B3 FEEDBACK	
		FKB4	ON/OFF	COMPRESSOR B4 FEEDBACK	
		OIL.B	OPEN/CLSE	OIL PRESSURE SWITCH B	
4-20		DMND	XX.X MA	4-20 MA DEMAND SIGNAL	
		RSET	XX.X MA	4-20 MA RESET SIGNAL	
		CSP	XX.X MA	4-20 MA COOLING SETPOINT	




Table 14 — Outputs Mode and Sub-Mode Directory

SUB-MODE	KEYPAD ENTRY	ITEM	DISPLAY	ITEM EXPANSION	COMMENT
GEN.O		C.PMP	ON/OFF	COOLER PUMP RELAY	
		H.GAS	ON/OFF	HOT GAS BYPASS RELAY	
CIR.A		FR.A1	ON/OFF	FAN A1 RELAY	
		FR.A2	ON/OFF	FAN A2 RELAY	
		CC.A1	ON/OFF	COMPRESSOR A1 RELAY	
		CC.A2	ON/OFF	COMPRESSOR A2 RELAY	
		CC.A3	ON/OFF	COMPRESSOR A3 RELAY	
		CC.A4	ON/OFF	COMPRESSOR A4 RELAY	
		UL.A1	ON/OFF	UNLOADER A1 RELAY	
		UL.A2	ON/OFF	UNLOADER A2 RELAY	
		EXV.A	XXX.X %	EXV % OPEN	
					
CIR.B		FR.B1	ON/OFF	FAN B1 RELAY	
		FR.B2	ON/OFF	FAN B2 RELAY	
		CC.B1	ON/OFF	COMPRESSOR B1 RELAY	
		CC.B2	ON/OFF	COMPRESSOR B2 RELAY	
		CC.B3	ON/OFF	COMPRESSOR B3 RELAY	
		CC.B4	ON/OFF	COMPRESSOR B4 RELAY	
		UL.B1	ON/OFF	UNLOADER B1 RELAY	
		UL.B2	ON/OFF	UNLOADER B2 RELAY	
		EXV.B	XXX.X %	EXV % OPEN	
					

LEGEND

EXV — Electronic Expansion Valve

Table 15 — Configuration Mode and Sub-Mode Directory

SUB-MODE	KEYPAD ENTRY	ITEM	DISPLAY	ITEM EXPANSION	COMMENT
DISP		TEST	ON/OFF	TEST DISPLAY LEDS	
		METR	ON/OFF	METRIC DISPLAY	Off = English On = Metric
		LANG	X	LANGUAGE SELECTION	Default: 0 0 = English 1 = Espanol 2 = Francais 3 = Portugues

LEGEND

CCN — Carrier Comfort Network
EMM — Energy Management Module
EXV — Electronic Expansion Valve
LCW — Leaving Chilled Water

Table 15 — Configuration Mode and Sub-Mode Directory (cont)

SUB-MODE	KEYPAD ENTRY	ITEM	DISPLAY	ITEM EXPANSION	COMMENT		
UNIT		TYPE	X	UNIT TYPE	Default: 1 1 = Air Cooled		
		TONS	XXX	UNIT SIZE			
		CAP.A	XXX	CIRCUIT A % CAPACITY	Unit Size	60 Hz	50 Hz
					040	50	43
					045	43	46
					050	46	43
					060	43	50
					070	50	57
					080*	56	62
					090*	50	54
					100*	50	50
					110*	54	50
					130*	50	52
					150*	50	60
					170*	50	48
					190*	50	50
					210*	50	52
					*And associated modular units.		
		CMP.A	X	NUMBER CIRC A COMPRESSOR			
		CYL.A	X	COMPRESSOR A1 CYLINDERS	4 = 040, 045 (60 Hz) 6 = 045 (50 Hz), 050-420		
		CMP.B	X	NUMBER CIRC B COMPRESSOR			
		CYL.B	X	COMPRESSOR B1 CYLINDERS	4 = 040 (60 Hz) 6 = 040 (50 Hz), 045-420		
		EXV	YES/NO	EXV MODULE INSTALLED			
		SH.SP	Δ F	EXV SUPERHEAT SETPOINT	29		
		SH.OF	Δ F	EXV SUPERHEAT OFFSET	Default: 0 Range: -30 to 30 F		
		REFG	X	REFRIGERANT	1 = R-22		
		FAN.S	X	FAN STAGING SELECT	1 = 2 Stage Independent (190-210, 290A, 315A, 360B [60 Hz], 390A/B-420A/B) 2 = 3 Stage Independent (130 [50 Hz], 150, 170, 230A-270A, 330A/B, 360B [50 Hz]) 3 = 2 Stage Common (040-090, 230B, 245B) 4 = 3 Stage Common (100-110, 130 [60 Hz], 255B-315B)		
OPT1		FLUD	X	COOLER FLUID	Default: 1 1 = Water 2 = Medium Temperature Brine 3 = Low Temperature Brine (Not Supported)		
		HGB.S	YES/NO	HOT GAS BYPASS SELECT			
		HPCM	X	HEAD PRESS. CONT. METHOD	Default: 2 1 = EXV Control 2 = Set Point Control 3 = Set Point Circuit A, EXV Circuit B 4 = EXV Circuit A, Set Point Circuit B		
		HPCT	X	HEAD PRESS. CONTROL TYPE	Default: 1 1 = No Control 2 = Air Cooled		
		PRTS	YES/NO	PRESSURE TRANSDUCERS	CURRENTLY NOT SUPPORTED		
		PMP.I	ON/OFF	COOLER PUMP INTERLOCK	Default: On		
		CPC	ON/OFF	COOLER PUMP CONTROL	Default: Off		
		CA.UN	X	NO. CIRCUIT A UNLOADERS			
		CB.UN	X	NO. CIRCUIT B UNLOADERS			
		EMM	YES/NO	EMM MODULE INSTALLED			

LEGEND

CCN — Carrier Comfort Network
EMM — Energy Management Module
EXV — Electronic Expansion Valve
LCW — Leaving Chilled Water

Table 15 — Configuration Mode and Sub-Mode Directory (cont)






















































SUB-MODE	KEYPAD ENTRY	ITEM	DISPLAY	ITEM EXPANSION	COMMENT
OPT2		CTRL	X	CONTROL METHOD	Default: 0 0 = Switch 1 = 7 Day Schedule 2 = Occupancy 3 = CCN Control
		CCNA	XXX	CCN ADDRESS	Default: 1 Range: 1 to 239
		CCNB	XXX	CCN BUS NUMBER	Default: 0 Range: 0 to 239
		BAUD	X	CCN BAUD RATE	Default: 3 1 = 2400 2 = 4800 3 = 9600 4 = 19,200 5 = 38,400
		LOAD	X	LOADING SEQUENCE SELECT	Default: 1 1 = Equal 2 = Staged
		LLCS	X	LEAD/LAG CIRCUIT SELECT	Default: 1 (size 080-420) 2 (size 040-070) 1 = Automatic 2 = Circuit A Leads 3 = Circuit B Leads
		LCWT	XX.X ΔF	HIGH LCW ALERT LIMIT	Default: 60 Range: 2 to 60 F
		DELY	XX	MIN MINUTES OFF TIME	Default: 0 Minutes Range: 0 to 15 Minutes
RSET		CRST	X	COOLING RESET TYPE	0 = No Reset 1 = 4 to 20 mA Input 2 = Outdoor Air Temperature 3 = Return Fluid 4 = Space Temperature
		CRT1	XXX.X °F	NO COOL RESET TEMP	Default: 125 F Range: 0 to 125 F
		CRT2	XXX.X °F	FULL COOL RESET TEMP	Default: 0° F Range: 0 to 125 F
		DGRC	XX.X ΔF	DEGREES COOL RESET	Default: 0° F Range: -30 to 30 F
		DMDC	X	DEMAND LIMIT SELECT	Default: 0 0 = None 1 = Switch 2 = 4 to 20 mA Input 3 = CCN Loadshed
		DM20	XXX %	DEMAND LIMIT AT 20 MA	Default: 100% Range: 0 to 100%
		SHNM	XXX	LOADSHED GROUP NUMBER	Default: 0 Range: 0 to 99
		SHDL	XXX %	LOADSHED DEMAND DELTA	Default: 0% Range: 0 to 60%
		SHTM	XXX MIN	MAXIMUM LOADSHED TIME	Default: 60 minutes Range: 0 to 120 minutes
		DLS1	XXX %	DEMAND LIMIT SWITCH 1	Default: 80% Range: 0 to 100%
		DLS2	XXX %	DEMAND LIMIT SWITCH 2	Default: 50% Range: 0 to 100%
		LLEN	ENBL/DSBL	LEAD/LAG CHILLER ENABLE	Default: Disable
		MSSL	SLVE/MAST	MASTER/SLAVE SELECT	Default: Master
		SLVA	XXX	SLAVE ADDRESS	Default: 0 Range: 0 to 239
		LLBL	ENBL/DSBL	LEAD/LAG BALANCE SELECT	Default: Disable
		LLBD	XXX HRS	LEAD/LAG BALANCE DELTA	Default: 168 hours Range: 40 to 400 Hours
		LLDY	XX MIN	LAG START DELAY	Default: 5 minutes Range: 0 to 30 minutes
SLCT		CLSP	X	COOLING SETPOINT SELECT	Default: 0 0 = Single 1 = Dual Switch 2 = Dual Clock 3 = 4 to 20 mA Input
		RL.S	ENBL/DSBL	RAMP LOAD SELECT	Default: Enable
		CRMP	X.X	COOLING RAMP LOADING	Default: 1.0 Range: 0.2 to 2.0
		Z.GN	X.X	DEADBAND MULTIPLIER	Default: 1.0 Range: 1.0 to 4.0

Table 16 — Example of Temperature Reset (Outdoor Air) Configuration

SUB-MODE	KEYPAD ENTRY	ITEM	DISPLAY	ITEM EXPANSION	COMMENT
RSET		CRST	0	COOLING RESET TYPE	0 = No reset 1 = 4 to 20 mA input 2 = Outdoor Air Temp 3 = Return Fluid 4 = Space Temperature
			0		Scrolling stops
			0		Value flashes
			2		Select 2
			2		Change accepted
		CRST	2		Item/Value/Units scrolls again
		CRT1	125		Range: 0 to 125 F
			125		Scrolling stops
			125		Value flashes
			75		Select 75
			75		Change accepted
		CRT1	75		Item/Value/Units scrolls again
		CRT2	0		Range: 0 to 125 F
			0		Scrolling stops
			0		Value flashes
			50		Select 50
			50		Change accepted
		CRT2	50		Item/Value/Units scrolls again
		DGRC	0		Range: -30 to 30 F
			0		Scrolling stops
			0		Value flashes
			10		Select 10
			10		Change accepted
		DGRC	10		Item/Value/Units scrolls again

NOTE: The example below shows how to configure the chiller for temperature reset by an accessory outdoor-air temperature sensor. The chiller will be configured for a full reset of 10 degrees at 50 F and no reset at 75 F.

Table 17 — Example of Configuring Dual Chiller Control




























SUB-MODE	KEYPAD ENTRY	ITEM	DISPLAY	ITEM EXPANSION	COMMENT
RSET		CRST	0		
		LLDY	5	LAG START DELAY	
			5		Scrolling stops
			5		Value flashes
			10		Select 10
			10		Change accepted
		LLDY	10		
		LLBD	168	LEAD/LAG BALANCE DELTA	No change needed. Default set for weekly changeover
		LLBL	DSBL	LEAD/LAG BALANCE SELECT	
			DSBL		Scrolling stops
			DSBL		Value flashes
			ENBL		Select Enable
			ENBL		Change accepted
		LLBL	ENBL		
		SLVA	0	SLAVE ADDRESS	
			0		Scrolling stops
			0		Value flashes
			6		Select 6
			6		Change accepted
		SLVA	6		
		MSSL	MAST	MASTER/SLAVE SELECT	No change needed. Default set for Master
		LLEN	DSBL	LEAD/LAG CHILLER ENABLE	
			DSBL		Scrolling stops
			DSBL		Value flashes
			MAST		Select Master
		LLEN	MAST		Change accepted
		LLEN	MAST	LEAD/LAG CHILLER ENABLE	Item/Value/Units scrolls again

Table 18 — Example of Compressor Lead/Lag Configuration












SUB-MODE	KEYPAD ENTRY	ITEM	DISPLAY	ITEM EXPANSION	COMMENT
OPT2		CTRL	0	CONTROL METHOD	
		CCNA	1		
		CCNB	0		
		BAUD	3		
		LOAD	1		
		LLCS	1	LEAD/LAG CIRCUIT SELECT	DEFAULT: 2 (040-070); 1 (080-420)
			1		Scrolling stops
			1		Value flashes
			3		Select 3 NOTE: Options 1 and/or 3 not valid for sizes 040-070 without Circuit B accessory unloader installed
			3		Change accepted
		LLCS	3	LEAD/LAG CIRCUIT SELECT	Item/Value/Units scrolls again

Table 19 — Time Clock Mode and Sub-Mode Directory

SUB-MODE	KEYPAD ENTRY	ITEM	DISPLAY	ITEM EXPANSION	COMMENT
TIME		HH.MM	XX.XX	HOUR AND MINUTE	Military (00.00-23.59)
DATE		MNTH	XX	MONTH	1=Jan, 2=Feb, etc.
		DOM	XX	DATE OF MONTH	Range 1-31
		DAY	X	DAY OF WEEK	1=Mon, 2=Tue, etc.
		YEAR	XXXX	YEAR OF CENTURY	
SCHD		MON.O	XX.XX	MONDAY OCCUPIED TIME	Range: 00.00 to 23.59 Default: 00.00
		MON.U	XX.XX	MONDAY UNOCCUPIED TIME	Range: 00.00 to 23.59 Default: 00.00
		TUE.O	XX.XX	TUESDAY OCCUPIED TIME	Range: 00.00 to 23.59 Default: 00.00
		TUE.U	XX.XX	TUESDAY UNOCCUPIED TIME	Range: 00.00 to 23.59 Default: 00.00
		WED.O	XX.XX	WEDNESDAY OCCUPIED TIME	Range: 00.00 to 23.59 Default: 00.00
		WED.U	XX.XX	WEDNESDAY UNOCC TIME	Range: 00.00 to 23.59 Default: 00.00
		THU.O	XX.XX	THURSDAY OCCUPIED TIME	Range: 00.00 to 23.59 Default: 00.00
		THU.U	XX.XX	THURSDAY UNOCCUPIED TIME	Range: 00.00 to 23.59 Default: 00.00
		FRI.O	XX.XX	FRIDAY OCCUPIED TIME	Range: 00.00 to 23.59 Default: 00.00
		FRI.U	XX.XX	FRIDAY UNOCCUPIED TIME	Range: 00.00 to 23.59 Default: 00.00
		SAT.O	XX.XX	SATURDAY OCCUPIED TIME	Range: 00.00 to 23.59 Default: 00.00
		SAT.U	XX.XX	SATURDAY UNOCCUPIED TIME	Range: 00.00 to 23.59 Default: 00.00
		SUN.O	XX.XX	SUNDAY OCCUPIED TIME	Range: 00.00 to 23.59 Default: 00.00
		SUN.U	XX.XX	SUNDAY UNOCCUPIED TIME	Range: 00.00 to 23.59 Default: 00.00

Table 20 — Setting an Occupied Time Schedule



























SUB-MODE	KEYPAD ENTRY	ITEM	DISPLAY	ITEM EXPANSION	COMMENT
SCHD		MON.O	00.00	MONDAY OCCUPIED TIME	TIME IN MILITARY FORMAT (HH.MM)
			00.00		Scrolling stops
			00.00		Hours flash
			07.00		Select 7 AM
			07.00		Change accepted, minutes flash
			07.30		Select 30
			07.30		Change accepted
		MON.O	07.30	MONDAY OCCUPIED TIME	Item/Value/Units scrolls again

Table 21 — Operating Mode and Sub-Mode Directory

SUB-MODE	KEYPAD ENTRY	ITEM	DISPLAY	ITEM EXPANSION	COMMENT
MODE		MD01	ON/OFF	FSM CONTROLLING CHILLER	
		MD02	ON/OFF	WSM CONTROLLING CHILLER	
		MD03	ON/OFF	MASTER/SLAVE CONTROL	
		MD04	ON/OFF	LOW SOURCE PROTECTION	
		MD05	ON/OFF	RAMP LOAD LIMITED	
		MD06	ON/OFF	TIMED OVERRIDE IN EFFECT	
		MD07	ON/OFF	LOW COOLER SUCTION TEMP A	
		MD08	ON/OFF	LOW COOLER SUCTION TEMP B	
		MD09	ON/OFF	SLOW CHANGE OVERRIDE	
		MD10	ON/OFF	MINIMUM OFF TIME ACTIVE	
		MD11	ON/OFF	LOW SUCTION SUPERHEAT A	
		MD12	ON/OFF	LOW SUCTION SUPERHEAT B	
		MD13	ON/OFF	DUAL SETPOINT	
		MD14	ON/OFF	TEMPERATURE RESET	
		MD15	ON/OFF	DEMAND LIMIT IN EFFECT	
		MD16	ON/OFF	COOLER FREEZE PROTECTION	
		MD17	ON/OFF	LO TMP COOL/HI TMP HEAT	
		MD18	ON/OFF	HI TMP COOL/LO TMP HEAT	

LEGEND

FSM — Flotronic™ System Manager
WSM — Water System Manager

Table 22 — Operating Modes

MODE NO.	ITEM EXPANSION	DESCRIPTION
01	FSM CONTROLLING CHILLER	Flotronic™ System Manager (FSM) is controlling the chiller
02	WSM CONTROLLING CHILLER	Water System Manager (WSM) is controlling the chiller
03	MASTER/SLAVE CONTROL	Lead/Lag Chiller control is enabled.
04	LOW SOURCE PROTECTION	Not currently supported.
05	RAMP LOAD LIMITED	Ramp load (pulldown) limiting in effect. In this mode, the rate at which leaving fluid temperature is dropped is limited to a predetermined value to prevent compressor overloading. See CRMP set point in the Set Point Select (SLCT) section of the Configuration mode. The pulldown limit can be modified, if desired, to any rate from 0.2° F to 2° F (0.1 to 1 C)/minute.
06	TIMED OVERRIDE IN EFFECT	Timed override is in effect. This is a 1 to 4 hour temporary override of the programmed schedule, forcing unit to Occupied mode. Override can be implemented with unit under Local (Enable) or CCN control. Override expires after each use.
07	LOW COOLER SUCTION TEMP A	Circuit A capacity may be limited due to operation of this mode. Control will attempt to correct this situation for up to 10 minutes before shutting the circuit down. The control may decrease capacity when attempting to correct this problem. See Alarms and Alerts section for more information.
08	LOW COOLER SUCTION TEMP B	Circuit B capacity may be limited due to operation of this mode. Control will attempt to correct this situation for up to 10 minutes before shutting the circuit down. The control may decrease capacity when attempting to correct this problem. See Alarms and Alerts section for more information.
09	SLOW CHANGE OVERRIDE	Slow change override is in effect. The leaving fluid temperature is close to and moving towards the control point.
10	MINIMUM OFF TIME ACTIVE	Chiller is being held off by Minutes Off Time (DELY) found under Options 2 (OPT2) section of Configuration mode.
11	LOW SUCTION SUPERHEAT A	Circuit A capacity may be limited due to operation of this mode. Control will attempt to correct this situation for up to 5 minutes before shutting the circuit down. See Alarms and Alerts section for more information.
12	LOW SUCTION SUPERHEAT B	Circuit B capacity may be limited due to operation of this mode. Control will attempt to correct this situation for up to 5 minutes before shutting the circuit down. See Alarms and Alerts section for more information.
13	DUAL SETPOINT	Dual set point mode is in effect. Chiller controls to CSP.1 during occupied periods and CSP.2 during unoccupied periods. Both CSP.1 and CSP.2 are located under COOL in the Set Point mode.
14	TEMPERATURE RESET	Temperature reset is in effect. In this mode, chiller is using temperature reset to adjust leaving fluid set point upward and is currently controlling to the modified set point. The set point can be modified based on return fluid, outdoor-air-temperature, space temperature, or 4 to 20 mA signal.
15	DEMAND LIMIT IN EFFECT	Demand limit is in effect. This indicates that the capacity of the chiller is being limited by demand limit control option. Because of this limitation, the chiller may not be able to produce the desired leaving fluid temperature. Demand limit can be controlled by switch inputs or a 4 to 20 mA signal.
16	COOLER FREEZE PROTECTION	Cooler fluid temperatures are approaching the Freeze point (see Alarms and Alerts section for definition). The chiller will be shut down when either fluid temperature falls below the Freeze point.
17	LO TMP COOL/HI TMP HEAT	Chiller is in Cooling mode and the rate of change of the leaving fluid is negative and decreasing faster than -0.5° F per minute. Error between leaving fluid and control point exceeds fixed amount. Control will automatically unload the chiller if necessary.
18	HI TMP COOL/LO TMP HEAT	Chiller is in Cooling mode and the rate of change of the leaving fluid is positive and increasing. Error between leaving fluid and control point exceeds fixed amount. Control will automatically load the chiller if necessary to better match the increasing load.

Table 23 — Alarms Mode and Sub-Mode Directory











SUB-MODE	KEYPAD ENTRY	ITEM	ITEM EXPANSION	COMMENT
CRNT		AXXX or TXXX	CURRENTLY ACTIVE ALARMS	Alarms are shown as AXXX. Alerts are shown as TXXX.
RCRN		YES/NO	RESET ALL CURRENT ALARMS	
HIST		AXXX or TXXX	ALARM HISTORY	Alarms are shown as AXXX. Alerts are shown as TXXX.
RHIS		YES/NO	RESET ALARM HISTORY	

Table 24 — Example of Reading and Clearing Alarms

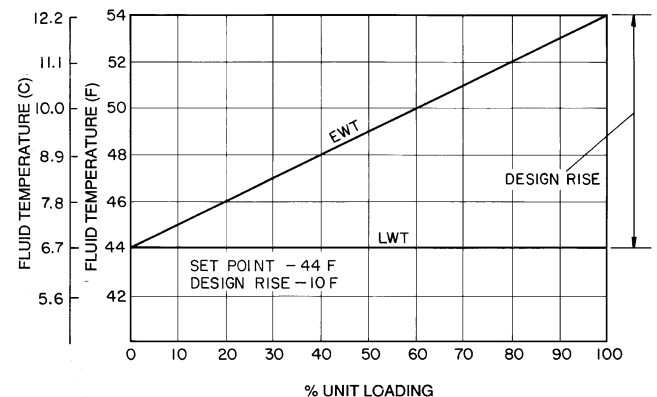
SUB-MODE	KEYPAD ENTRY	ITEM	ITEM EXPANSION	COMMENT
CRNT		AXXX or TXXX	CURRENTLY ACTIVE ALARMS	ACTIVE ALARMS (AXXX) OR ALERTS (TXXX) DISPLAYED.
CRNT				
RCRN		NO		Use to clear active alarms/alerts
		NO		NO Flashes
		YES		Select YES
		NO		Alarms/alerts clear, YES changes to NO

Temperature Reset — The control system is capable of handling leaving-fluid temperature reset based on return cooler fluid temperature. Because the change in temperature through the cooler is a measure of the building load, the return temperature reset is in effect an average building load reset method. The control system is also capable of temperature reset based on outdoor-air temperature (OAT), space temperature (SPT), or from an externally powered 4 to 20 mA signal. Accessory sensors must be used for OAT and SPT reset (HH79NZ014 for OAT and HH51BX006 for SPT). The Energy Management Module (EMM) must be used for temperature reset using a 4 to 20 mA signal.

To use the return reset, four variables must be configured. In the Configuration mode under the sub-mode RSET, items CRST, CRT1, CRT2, and DGRC must be set properly. See Table 25 on page 42 for correct configuration. See Fig. 2-4 for wiring details.

Under normal operation, the chiller will maintain a constant leaving fluid temperature approximately equal to the chilled fluid set point. As the cooler load varies, the entering cooler fluid will change in proportion to the load as shown in Fig. 20. Usually the chiller size and leaving-fluid temperature set point are selected based on a full-load condition. At part load, the fluid temperature set point may be colder than required. If the leaving fluid temperature was allowed to increase at part load, the efficiency of the machine would increase.

Return temperature reset allows for the leaving temperature set point to be reset upward as a function of the return fluid temperature or, in effect, the building load.



LEGEND

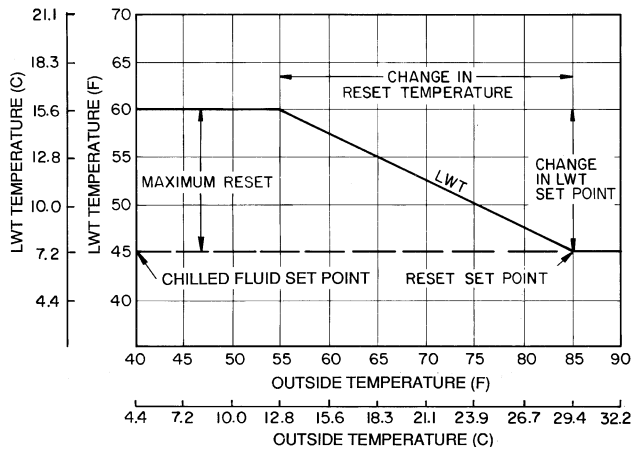
EWT — Entering Water (Fluid) Temperature
LWT — Leaving Water (Fluid) Temperature

Fig. 20 — Standard Chilled Fluid Temperature Control — No Reset

Table 25 — Configuring Temperature Reset

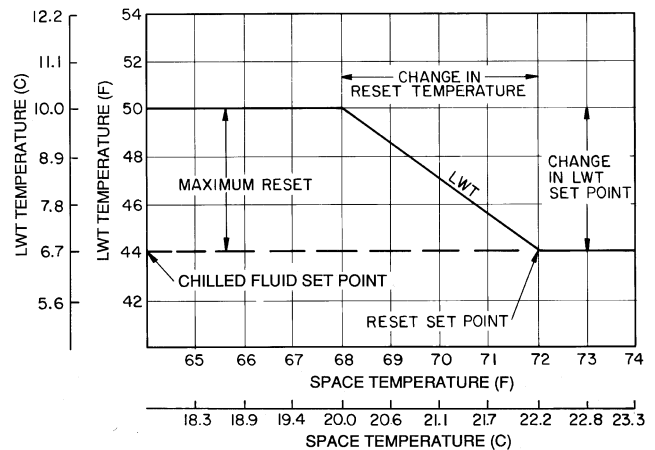
MODE GREEN LED)	KEYPAD ENTRY	SUB-MODE	KEYPAD ENTRY	ITEM	DISPLAY	ITEM EXPANSION	COMMENT
CONFIGURATION		DISP		TEST	ON/OFF	TEST DISPLAY LEDs	
		UNIT		TYPE	X	UNIT TYPE	
		OPT1		FLUD	X	COOLER FLUID	
		OPT2		CTRL	X	CONTROL METHOD	
		RSET		CRST	X	COOLING RESET TYPE	0 = No Reset 1 = 4 to 20 mA Input (EMM required) (Connect to EMM J6-2,5) 2 = Outdoor-Air Temperature (Connect to TB5-7,8) 3 = Return Fluid (Connect to TB5-5,6) 4 = Space Temperature
				CRT1	XXX.X F	NO COOL RESET TEMP	Default: 125 F (51.7 C) Range: 0 to 125 F Set to 4.0 for CRST= 1
				CRT2	XXX.X F	FULL COOL RESET TEMP	Default: 0° F (-17.8 C) Range: 0 to 125 F Set to 20.0 for CRST=1
				DGRC	XX.X °F	DEGREES COOL RESET	Default: 0° F (0° C) Range: -30 to 30° F (-16.7 to 16.7 C)

The following are examples of outdoor air and space temperature resets:



LEGEND

LWT — Leaving Water (Fluid) Temperature



LEGEND

LWT — Leaving Water (Fluid) Temperature

Demand Limit — Demand Limit is a feature that allows the unit capacity to be limited during periods of peak energy usage. There are 3 types of demand limiting that can be configured. The first type is through 2-stage switch control, which will reduce the maximum capacity to 2 user-configurable percentages. The second type is by 4 to 20 mA signal input which will reduce the maximum capacity linearly between 100% at a 4 mA input signal (no reduction) down to the user-configurable level at a 20 mA input signal. The third type uses the CCN Loadshed module and has the ability to limit the current operating capacity to maximum and further reduce the capacity if required.

NOTE: The 2-stage switch control and 4 to 20 mA input signal types of demand limiting require the Energy Management Module (EMM).

To use Demand Limit, select the type of demand limiting to use. Then configure the Demand Limit set points based on the type selected.

DEMAND LIMIT (2-Stage Switch Controlled) — To configure Demand Limit for 2-stage switch control set the Demand Limit Select (DMDC) to 1. Then configure the 2 Demand Limit Switch points (DLS1 and DLS2) to the desired capacity limit. See Table 26. Capacity steps are controlled by 2 relay switch inputs field wired to TB6 as shown in Fig. 2-4.

For Demand Limit by 2-stage switch control, closing the first stage demand limit contact will put the unit on the first demand limit level. The unit will not exceed the percentage of capacity entered as Demand Limit Switch 1 set point. Closing contacts on the second demand limit switch prevents the unit from exceeding the capacity entered as Demand Limit Switch 2 set point. The demand limit stage that is set to the

lowest demand takes priority if both demand limit inputs are closed. If the demand limit percentage does not match unit staging, the unit will limit capacity to the closest capacity stage.





















To disable demand limit configure the DMDC to 0. See Table 25.

EXTERNALLY POWERED DEMAND LIMIT (4 to 20 mA Controlled) — To configure Demand Limit for 4 to 20 mA control set the Demand Limit Select (DMDC) to 2. Then configure the Demand Limit at 20 mA (DM20) to the maximum loadshed value desired. The control will reduce allowable capacity to this level for the 20 mA signal. See Table 26 and Fig. 21.

DEMAND LIMIT (CCN Loadshed Controlled) — To configure Demand Limit for CCN Loadshed control set the Demand Limit Select (DMDC) to 3. Then configure the Loadshed Group Number (SHNM), Loadshed Demand Delta (SHDL), and Maximum Loadshed Time (SHTM). See Table 26.

The Loadshed Group number is established by the CCN system designer. The PIC (product integrated control) will respond to a Redline command from the Loadshed control. When the Redline command is received, the current stage of capacity is set to the maximum stages available. Should the loadshed control send a Loadshed command, the PIC will reduce the current stages by the value entered for Loadshed Demand delta. The Maximum Loadshed Time is the defines the maximum length of time that a loadshed condition is allowed to exist. The control will disable the Redline/Loadshed command if no Cancel command has been received within the configured maximum loadshed time limit.

Table 26 — Configuring Demand Limit

MODE	KEYPAD ENTRY	SUB-MODE	KEYPAD ENTRY	ITEM	DISPLAY	ITEM EXPANSION	COMMENT
CONFIGURATION		DISP		TEST	ON/OFF	Test Display LEDs	
		UNIT		TYPE	X	Unit Type	
		OPT1		FLUD	X	Cooler Fluid	
		OPT2		CTRL	X	Control Method	
		RSET		CRST	X	Cooling Reset Type	
				CRT1	XXX.X °F	No Cool Reset Temperature	
				CRT2	XXX.X °F	Full Cool Reset Temperature	
				DGRC	XX.X ΔF	Degrees Cool Reset	
				DMDC	X	Demand Limit Select	Default: 0 0 = None 1 = Switch 2 = 4 to 20 mA Input 3 = CCN Loadshed
				DM20	XXX %	Demand Limit at 20 mA	Default: 100% Range: 0 to 100
				SHNM	XXX	Loadshed Group Number	Default: 0 Range: 0 to 99
				SHDL	XXX%	Loadshed Demand Delta	Default: 0% Range: 0 to 60%
				SHTM	XXX MIN	Maximum Loadshed Time	Default: 60 min. Range: 0 to 120 min.
				DLS1	XXX %	Demand Limit Switch 1	Default: 80% Range: 0 to 100%
				DLS2	XXX%	Demand Limit Switch 2	Default: 50% Range: 0 to 100

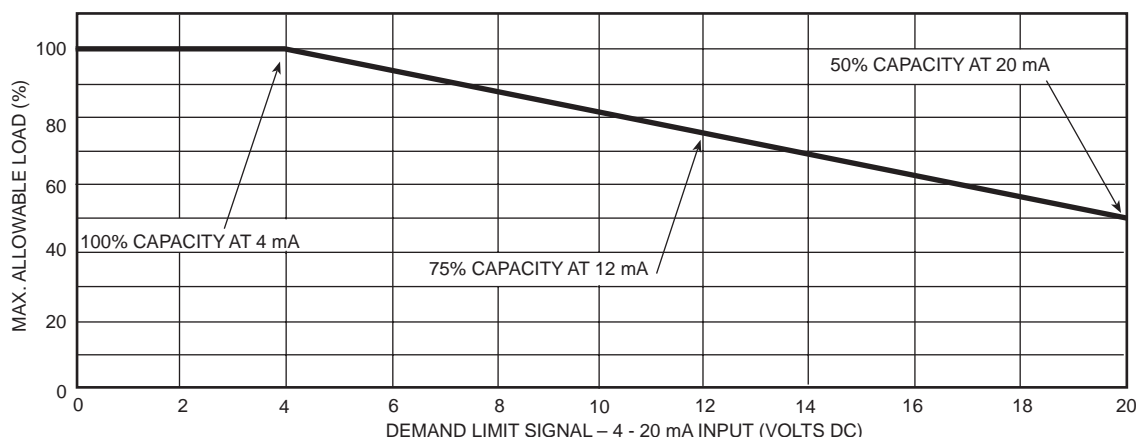


Fig. 21 — 4 to 20 mA Demand Limiting

TROUBLESHOOTING

Compressor Protection Control System (CPCS)

Board — The compressor protection board controls the compressor and compressor crankcase heater.

The ground current protection is provided by the compressor board.

The large relay located on the board is used to provide a feedback signal to the Main Base Board.

The operation of the compressor board can be checked using the Service Test procedure. When the Service Test step is turned on, the compressor board is energized. All safeties are continuously monitored. The crankcase heater will be turned off and the compressor contactor will be turned on. The feedback contacts will close and the Main Base Board (MBB) will read the feedback status.

If the board does not perform properly, use standard wiring troubleshooting procedures to check the wiring for open circuits. Refer to Alarms and Alerts section on page 45 for alarm or alert codes for possible causes for failure.

If a compressor short-to-ground exists, the compressor board may detect the short before the circuit breaker trips. If this is suspected, check the compressor for short-to-ground failures with an ohmmeter. The ground current is sensed with a current toroid (coil) around all 3 or 6 wires between the main terminal block and the compressor circuit breaker(s).

Compressor Ground Current (CGC) Board (30GTN,R130-210, 230A-315A, and 330A/B-420A/B)

— One board is used for each circuit of these units. Each board receives input from up to 4 toroids wired in series, one toroid per compressor. With 24 v supplied at terminals A and B, a current imbalance (compressor ground current) sensed by any toroid causes the NC (normally closed) contacts to open, shutting down the lead compressor in the affected circuit. All other compressors in that circuit shut down as a result. The NC contacts remain open until the circuit is reset by momentarily deenergizing the board using the push-button switch.

If the NC contacts open, it is necessary to remove toroids from the T1-T2 circuit to determine which toroid is causing the trip. The chiller circuit can then be put back on line after the circuit breaker of the faulty compressor is opened. The compressor problem can then be diagnosed by normal troubleshooting procedures.

EXV Troubleshooting — If it appears that the EXV is not properly controlling operating suction pressure or superheat, there are a number of checks that can be made using

the quick test and initialization features built into the ComfortLink™ control.

Follow the procedure below to diagnose and correct EXV problems.

STEP 1 — CHECK PROCESSOR EXV OUTPUTS — Check EXV output signals at the J6 and J7 terminals of the EXV board.

Turn unit power off. Connect the positive lead of the meter to terminal 3 on connector J6 on the EXV board. Set meter for approximately 20 vdc. Turn unit power on. Enter and enable the Service Test mode. Locate the appropriate valve under 'OUTS.' Select the desired percentage and press Enter to move the valve. The valve will overdrive in both directions when either 0% or 100% are entered. During this time, connect the negative test lead to terminals 1, 2, 4, and 5 in succession. The voltage should fluctuate at each pin. If it remains constant at a voltage or at 0 v, replace the EXV board. If the outputs are correct, then check the EXV.

To test Circuit B outputs, follow the same procedure above, except connect the positive lead of the meter to terminal 3 on connector J7 on the EXV board and the negative lead to terminals 1, 2, 4, and 5 in succession.

STEP 2 — CHECK EXV WIRING — Check wiring to EXVs from J6 and J7 terminal strips on EXV board.

1. Check color coding and wire connections. Make sure that wires are connected to correct terminals at J6 and J7 terminal strips and EXV plug connections. Check for correct wiring at driver board input and output terminals. See Fig. 2-4.
2. Check for continuity and tight connection at all pin terminals.
3. Check plug connections at J6 and J7 terminal strips and at EXVs. Be sure EXV connections are not crossed.

STEP 3 — CHECK RESISTANCE OF EXV MOTOR WINDINGS — Remove plug at J6 and/or J7 terminal strip and check resistance between common lead (red wire, terminal D) and remaining leads A, B, C, and E. Resistance should be 25 ohms \pm 2 ohms.

STEP 4 — CHECK THERMISTORS THAT CONTROL EXV — Check thermistors that control processor output voltage pulses to the EXVs. Circuit A thermistor is T7, and circuit B thermistor is T8. Refer to Fig. 9 and 10 for location.

1. Use service test to determine if thermistors are shorted or open.
2. Refer to Thermistors section on page 57 for details on checking thermistor calibration.

3. Make sure that thermistor leads are connected to the proper pin terminals at the J5 terminal strip on EXV board and that thermistor probes are located in proper position in the refrigerant circuit.

When these checks have been completed, the actual operation of the EXV can be checked by using the procedures outlined in Step 5 — Check Operation of the EXV section below.

STEP 5 — CHECK OPERATION OF THE EXV — Use the following procedure to check the actual operation of the EXVs. The ENABLE/OFF/REMOTE contact switch must be in the OFF position.

1. Close the liquid line service valve for the circuit to be checked and run through the appropriate service test to pump down the low side of the system. Run lead compressor for at least 30 seconds to ensure all refrigerant has been pumped from the low side and that the EXV has been driven fully open (1500 steps).

NOTE: Do not use the Emergency ON-OFF switch to recycle the control during this step.

2. Turn off the compressor circuit breaker(s) and the control circuit power and then turn the Emergency ON/OFF switch to the OFF position. Close compressor service valves and remove any remaining refrigerant from the low side of the system.
3. Remove screws holding top cover of EXV. Carefully remove top cover, using caution to avoid damage to the O-ring seal and motor leads. If EXV plug was disconnected during this process, reconnect it after the cover is removed.
4. Note position of lead screw (see Fig. 14). If valve has responded properly to processor signals in Step 5.1 above, the valve should be fully open and the lead screw should protrude approximately $\frac{1}{4}$ in. to $\frac{3}{4}$ in. above the top of the motor.
5. Recycle the control by turning the control circuit power on and switching the Emergency ON-OFF switch to the ON position. This puts the control in initialization mode. During the first 60 seconds of the initialization mode, each valve is driven to the fully closed position (1500 steps) by the processor. With the cover lifted off the EXV valve body, observe the operation of the valve motor and lead screw. The motor should turn in the counterclockwise (CCW) direction and the lead screw should move down into the motor hub until the valve is fully closed. Lead screw movement should be smooth and uniform from the fully open to the fully closed position.
6. When test has been completed, carefully reassemble expansion valve. Be careful not to damage motor or O-ring when reassembling valve. Open compressor service valves and close compressor circuit breakers. Open

liquid line service valve. Turn the ENABLE/OFF/REMOTE contact switch and allow unit to operate. Verify proper operation of unit.

This process of opening and closing the EXV (EXV.A/EXV.B under OUTS) can be repeated by using these Service Test steps and recycling the control as described in the preceding steps. If the valve does not operate as described when properly connected to the processor and receiving the correct signals, it should be replaced.

If operating problems persist after reassembly, they may be due to out-of-calibration thermistor(s) or intermittent connections between the EXV board terminals and the EXV plug. Recheck all wiring connections and voltage signals.

Other possible causes of improper refrigerant flow control could be restrictions in the liquid line. Check for plugged filter drier(s), restricted metering slots in the EXV, or partially closed liquid line service valves. Formation of ice or frost on the lower body of the EXV is one symptom of restricted metering slots. Clean or replace the valve if necessary. Wrap a wet cloth around the valve if it is to be replaced to prevent the heat from damaging the internal components of the valve.

NOTE: Frosting of the valve is normal during service test and at initial start-up. The frost should dissipate after 5 to 10 minutes operation of a system that is operating properly.

NOTE: The EXV orifice is a screw-in type and may be removed for inspection and cleaning. Once the top cover has been removed, the EXV motor may be taken out by removing the 2 cap screws securing motor to valve body. Pull motor, lead screw, and the slide assembly up off the orifice assembly. See Fig. 14. A slot has been cut in top of orifice assembly to facilitate removal using a large screwdriver. Turn orifice assembly counterclockwise to remove.

When cleaning or reinstalling orifice assembly, be careful not to damage orifice assembly seals. The bottom seal acts as a liquid shut-off, replacing a liquid line solenoid valve.

Reassembly of valve is made easier by screwing the slide and lead screw assembly out of the motor. Align hole in top of slide with the guide pin in orifice assembly and gently push slide and lead screw onto orifice assembly about half-way. Screw motor onto lead screw and secure EXV motor with cap screws. Be careful not to twist or pull on wires from EXV motor to valve cover pin connections. Check EXV operation in quick step steps.

Alarms and Alerts — These are warnings of abnormal or fault conditions, and may cause either one circuit or the whole unit to shut down. They are assigned code numbers as described in Table 27.

Table 27 — Alarm and Alert Codes

ALARM/ ALERT CODE	ALARM OR ALERT	DESCRIPTION	WHY WAS THIS ALARM GENERATED?	ACTION TAKEN BY CONTROL	RESET METHOD	PROBABLE CAUSE
51	Alert	Circuit A, Compressor 1 Failure	Compressor feedback signal does not match relay state	Circuit A shut down.	Manual	High-pressure or loss-of-charge switch open, faulty control relay or CPCS board, loss of condenser air, liquid valve closed, operation beyond capability.
52	Alert	Circuit A, Compressor 2 Failure	Compressor feedback signal does not match relay state	Circuit A shut down. Circuit restarted in 1 minute. Compressor A2 not used until alarm is reset.	Manual	High-pressure switch open, faulty control relay or CPCS board, loss of condenser air, liquid valve closed, operation beyond capability.
53	Alert	Circuit A, Compressor 3 Failure	Compressor feedback signal does not match relay state	Circuit A shut down. Circuit restarted in 1 minute. Compressor A3 not used until alarm is reset.	Manual	High-pressure switch open, faulty control relay or CPCS board, loss of condenser air, liquid valve closed, operation beyond capability.
54	Alert	Circuit A, Compressor 4 Failure	Compressor feedback signal does not match relay state	Circuit A shut down. Circuit restarted in 1 minute. Compressor A4 not used until alarm is reset.	Manual	High-pressure switch open, faulty control relay or CPCS board, loss of condenser air, liquid valve closed, operation beyond capability.
55	Alert	Circuit B, Compressor 1 Failure	Compressor feedback signal does not match relay state	Circuit B shut down.	Manual	High-pressure or loss-of-charge switch open, faulty control relay or CPCS board, loss of condenser air, liquid valve closed, operation beyond capability.
56	Alert	Circuit B, Compressor 2 Failure	Compressor feedback signal does not match relay state	Circuit B shut down. Circuit restarted in 1 minute. Compressor B2 not used until alarm is reset.	Manual	High-pressure switch open, faulty control relay or CPCS board, loss of condenser air, liquid valve closed, operation beyond capability.
57	Alert	Circuit B, Compressor 3 Failure	Compressor feedback signal does not match relay state	Circuit B shut down. Circuit restarted in 1 minute. Compressor B3 not used until alarm is reset.	Manual	High-pressure switch open, faulty control relay or CPCS board, loss of condenser air, liquid valve closed, operation beyond capability.
60	Alarm	Cooler Leaving Fluid Thermistor Failure (T1)	Thermistor outside range of -40 to 245 F (-40 to 118 C)	Chiller shutdown after pumpdown complete.	Automatic	Thermistor failure, damaged cable/wire or wiring error.
61	Alarm	Cooler Entering Fluid Thermistor Failure (T2)	Thermistor outside range of -40 to 245 F (-40 to 118 C)	Chiller shutdown after pumpdown complete.	Automatic	Thermistor failure, damaged cable/wire or wiring error.
64	Alert	Circuit A Saturated Condensing Thermistor Failure (T3)	Thermistor outside range of -40 to 245 F (-40 to 118 C)	Circuit A shutdown after pumpdown complete. (EXV only)	Automatic	Thermistor failure, damaged cable/wire or wiring error.
65	Alert	Circuit B Saturated Condensing Thermistor Failure (T4)	Thermistor outside range of -40 to 245 F (-40 to 118 C)	Circuit B shutdown after pumpdown complete.	Automatic	Thermistor failure, damaged cable/wire or wiring error.
66	Alert	Circuit A Saturated Suction Thermistor Failure (T5)	Thermistor outside range of -40 to 245 F (-40 to 118 C)	Circuit A shutdown after pumpdown complete. (EXV only)	Automatic	Thermistor failure, damaged cable/wire or wiring error.
67	Alert	Circuit B Saturated Suction Thermistor Failure (T6)	Thermistor outside range of -40 to 245 F (-40 to 118 C)	Circuit B shutdown after pumpdown complete.	Automatic	Thermistor failure, damaged cable/wire or wiring error.
68	Alert	Compressor A1 Suction Gas Thermistor Failure (T7)	Thermistor outside range of -40 to 245 F (-40 to 118 C)	Circuit A shutdown after pumpdown complete. (EXV only).	Automatic	Thermistor failure, damaged cable/wire or wiring error.
69	Alert	Compressor B1 Suction Gas Thermistor Failure (T8)	Thermistor outside range of -40 to 245 F (-40 to 118 C)	Circuit B shutdown after pumpdown complete. (EXV only).	Automatic	Thermistor failure, damaged cable/wire or wiring error.
73	Alert	Outside Air Thermistor Failure (T9)	Thermistor outside range of -40 to 245 F (-40 to 118 C)	Temperature reset disabled. Chiller runs under normal control/set points.	Automatic	Thermistor failure, damaged cable/wire or wiring error.
74	Alert	Space Temperature Thermistor Failure (T10)	Thermistor outside range of -40 to 245 F (-40 to 118 C)	Temperature reset disabled. Chiller runs under normal control/set points.	Automatic	Thermistor failure, damaged cable/wire or wiring error.
77	Alert	Circuit A Saturated Suction Temperature exceeds Cooler Leaving Fluid Temperature	Saturated suction is greater than leaving fluid temperature for more than 5 minutes	Circuit A shutdown after pumpdown complete.	Automatic	Faulty expansion valve or EXV board, faulty cooler suction thermistor (T5) or leaving fluid thermistor (T1).
78	Alert	Circuit B Saturated Suction Temperature exceeds Cooler Leaving Fluid Temperature	Saturated suction is greater than leaving fluid temperature for more than 5 minutes	Circuit B shutdown after pumpdown complete	Automatic	Faulty expansion valve or EXV board, faulty cooler suction thermistor (T6) or leaving fluid thermistor (T1).

Table 27 — Alarm and Alert Codes (cont)

ALARM/ ALERT CODE	ALARM OR ALERT	DESCRIPTION	WHY WAS THIS ALARM GENERATED?	ACTION TAKEN BY CONTROL	RESET METHOD	PROBABLE CAUSE
112	Alert	Circuit A High Suction Superheat	If EXV is greater than 98%, suction superheat is greater than 75 F (41.7 C) and saturated suction temperature is less than MOP for 5 minutes	Circuit A shutdown after pumpdown complete.	Manual	Faulty expansion valve or EXV board, low refrigerant charge, plugged filter drier, faulty suction gas thermistor (T7) or cooler thermistor (T5).
113	Alert	Circuit B High Suction Superheat	If EXV is greater than 98%, suction superheat is greater than 75 F (41.7 C) and saturated suction temperature is less than MOP for 5 minutes	Circuit B shutdown after pumpdown complete.	Manual	Faulty expansion valve or EXV board, low refrigerant charge, plugged filter drier, faulty suction gas thermistor (T8) or cooler thermistor (T6).
114	Alert	Circuit A Low Suction Superheat	If EXV is greater than 10%, and either suction superheat is less than 19 F (10.6 C) or saturated suction temperature is greater than MOP for 5 minutes	Circuit A shutdown after pumpdown complete.	Automatic restart after first daily occurrence. Manual restart thereafter.	Faulty expansion valve or EXV board, faulty suction gas thermistor (T7) or cooler thermistor (T5).
115	Alert	Circuit B Low Suction Superheat	If EXV is greater than 10%, and either suction superheat is less than 19 F (10.6 C) or saturated suction temperature is greater than MOP for 5 minutes	Circuit B shutdown after pumpdown complete.	Automatic restart after first daily occurrence. Manual restart thereafter.	Faulty expansion valve or EXV board, faulty suction gas thermistor (T8) or cooler thermistor (T6).
116	Alert	Circuit A Low Cooler Suction Temperature	1. If the saturated suction temperature is 24 to 29° F (13.3 to 16.1° C) below cooler LWT and is also 2° F (1.1° C) less than freeze* 2. If the saturated suction temperature is 30° F (16.7° C) below cooler LWT and is also 2° F (1.1° C) less than freeze* for 10 minutes	1. Mode 7 initiated. No additional capacity increases. Alert not tripped. 2. Circuit shutdown without going through pumpdown.	1. Automatic reset if corrected. 2. Manual	Faulty expansion valve or EXV board, low refrigerant charge, plugged filter drier, faulty suction gas thermistor (T7) or cooler thermistor (T5), low cooler fluid flow.
117	Alert	Circuit B Low Cooler Suction Temperature	1. If the saturated suction temperature is 24 to 29° F (13.3 to 16.1° C) below cooler LWT and is also 2° F (1.1° C) less than freeze* 2. If the saturated suction temperature is 30° F (16.7° C) below cooler LWT and is also 2° F (1.1° C) less than freeze* for 10 minutes	1. Mode 8 initiated. No additional capacity increases. Alert not tripped. 2. Circuit shutdown without going through pumpdown.	1. Automatic reset if corrected. 2. Manual	Faulty expansion valve or EXV board, low refrigerant charge, plugged filter drier, faulty suction gas thermistor (T8) or cooler thermistor (T6), low cooler fluid flow.
118	Alert	Circuit A Low Oil Pressure	Oil pressure switch open after 1 minute of continuous operation	Circuit shutdown without going through pumpdown.	Manual	Oil pump failure, low oil level, switch failure or compressor circuit breaker tripped.
119	Alert	Circuit B Low Oil Pressure	Oil pressure switch open after 1 minute of continuous operation	Circuit shutdown without going through pumpdown.	Manual	Oil pump failure, low oil level, switch failure or compressor circuit breaker tripped.

LEGEND

CCN	— Carrier Comfort Network
CPCS	— Compressor Protection Control System
CXB	— Compressor Expansion Board
EMM	— Energy Management Module
EXV	— Electronic Expansion Valve
FSM	— Flotronic™ System Manager
MBB	— Main Base Board
MOP	— Maximum Operating Pressure
WSM	— Water System Manager

*Freeze is defined as 34° F (1.1 C) for water. For brine fluids, freeze is CSP.1 –8° F (4.4 C) for single set point and lower of CSP.1/CSP.2 –8° F (4.4 C) for dual set point configuration.

NOTE: The following table shows illegal configurations:

1	Zero compressors in a circuit
2	Four compressors in a circuit with two unloaders
3	Four compressors in a circuit with one unloader and hot gas bypass
4	Two unloaders and hot gas bypass in a circuit.
5	More than one compressor quantity difference between circuits
6	Fluid type of low temperature brine
7	Air cooled head pressure control with common fan staging and different head pressure control methods for each circuit.

Table 27 — Alarm and Alert Codes (cont)

ALARM/ ALEERT CODE	ALARM OR ALERT	DESCRIPTION	WHY WAS THIS ALARM GENERATED?	ACTION TAKEN BY CONTROL	RESET METHOD	PROBABLE CAUSE
150	Alarm	Emergency Stop	CCN emergency stop command received	Chiller shutdown without going through pumpdown.	Automatic once CCN command for EMSTOP returns to normal	CCN Network command.
151	Alarm	Illegal Configuration	One or more of the illegal configurations shown in the Note below exists.	Chiller is not allowed to start.	Manual once configuration errors are corrected	Configuration error. See Note on page 49.
152	Alarm	Unit Down Due to Failure	Both circuits are down due to alarms/alerts.	Chiller is unable to run.	Automatic once alarms/alerts are cleared that prevent the chiller from starting.	Alarm notifies user that chiller is 100% down.
153	Alarm	Real Time Clock Hardware Failure	Internal clock on MBB fails	Occupancy schedule will not be used. Chiller defaults to Local On mode.	Automatic when correct clock control restarts.	Main Base Board failure.
154	Alarm	Serial EEPROM Hardware Failure	Hardware failure with MBB	Chiller is unable to run.	Manual	Main Base Board failure.
155	Alert	Serial EEPROM Storage Failure	Configuration/storage failure with MBB	No Action	Manual	Potential failure of MBB. Download current operating software. Replace MBB if error occurs again.
156	Alarm	Critical Serial EEPROM Storage Failure	Configuration/storage failure with MBB	Chiller is not allowed to run.	Manual	Main Base Board failure.
157	Alarm	A/D Hardware Failure	Hardware failure with peripheral device	Chiller is not allowed to run.	Manual	Main Base Board failure.
170	Alert	Loss of Communication with CXB	MBB loses communication with CXB	Compressors A3, A4 and B3 and unloaders A2/B2 unable to operate.	Automatic	Wiring error, faulty wiring or failed CXB module.
172	Alarm	Loss of Communication with EXV	MBB loses communication with EXV	Chiller shutdown without going through pumpdown.	Automatic	Wiring error, faulty wiring or failed EXV module.
173	Alert	Loss of Communication with EMM	MBB loses communication with EMM	4 to 20 mA temperature reset disabled. Demand Limit set to 100%. 4 to 20 mA set point disabled.	Automatic	Wiring error, faulty wiring or failed Energy Management Module (EMM).
174	Alert	4 to 20 mA Cooling Set Point Input Failure	If configured with EMM and input less than 2 mA or greater than 22 mA	Set point function disabled. Chiller controls to CSP1.	Automatic	Faulty signal generator, wiring error, or faulty EMM.
176	Alert	4 to 20 mA Temperature Reset Input Failure	If configured with EMM and input less than 2 mA or greater than 22 mA	Reset function disabled. Chiller returns to normal set point control.	Automatic	Faulty signal generator, wiring error, or faulty EMM.
177	Alert	4 to 20 mA Demand Limit Input Failure	If configured with EMM and input less than 2 mA or greater than 22 mA	Demand limit function disabled. Chiller returns to 100% demand limit control.	Automatic	Faulty signal generator, wiring error, or faulty EMM.
200	Alarm	Cooler Pump Interlock Failure to Close at Start-Up	If configured for cooler pump control and cooler pump interlock not closed within 1 minute after pump is started	Cooler pump shut off. Chiller shutdown without going through pumpdown.	Manual	Failure of cooler pump or controls.
201	Alarm	Cooler Pump Interlock Opened During Normal Operation	If configured for cooler pump control and interlock opens while cooler pump relay is on	Cooler pump shut off. Chiller shutdown without going through pumpdown.	Manual	Failure of cooler pump or controls.
202	Alarm	Cooler Pump Interlock Closed When Pump is Off	If configured for cooler pump control and interlock closes while cooler pump relay is off	Chiller is not allowed to start.	Manual	Failure of cooler pump relay or interlock, welded contacts.

Table 27 — Alarm and Alert Codes (cont)

ALARM/ ALEERT CODE	ALARM OR ALERT	DESCRIPTION	WHY WAS THIS ALARM GENERATED?	ACTION TAKEN BY CONTROL	RESET METHOD	PROBABLE CAUSE
203	Alert	Loss of Communication with Slave Chiller	Master MBB loses communication with Slave MBB	Dual chiller control disabled. Chiller runs as a stand-alone machine.	Automatic	Wiring error, faulty wiring, failed Slave MBB module, power loss at Slave chiller, wrong slave address.
204	Alert	Loss of Communication with Master Chiller	Slave MBB loses communication with Master MBB	Dual chiller control disabled. Chiller runs as a stand-alone machine	Automatic	Wiring error, faulty wiring, failed Master MBB module, power loss at Master chiller.
206	Alert	High Leaving Chilled Water Temperature	LWT read is greater than LCW Alert Limit, Total capacity is 100% and LWT is greater than LWT reading one minute ago	Alert only. No action taken.	Automatic	Building load greater than unit capacity, low water/brine flow or compressor fault. Check for other alarms/alerts.
207	Alarm	Cooler Freeze Protection	Cooler EWT or LWT is less than freeze*	Chiller shutdown without going through pumpdown. Cooler pump continues to run (if control enabled).	Automatic for first occurrence of day. Manual reset thereafter.	Faulty thermistor (T1/T2), low water flow.
208	Alarm	Low Cooler Fluid Flow	Cooler EWT is less than LWT by 3° F (1.7° C) for 1 minute after a circuit is started	Chiller shutdown without going through pumpdown. Cooler pump shut off (if control enabled).	Manual	Faulty cooler pump, low water flow, plugged fluid strainer.
950	Alert	Loss of Communication with WSM	No communications have been received by MBB within 5 minutes of last transmission	WSM forces removed. Chiller runs under own control.	Automatic	Failed module, wiring error, failed transformer, loose connection plug, wrong address.
951	Alert	Loss of Communication with FSM	No communications have been received by MBB within 5 minutes of last transmission	FSM forces removed. Chiller runs under own control.	Automatic	Failed module, wiring error, failed transformer, loose connection plug, wrong address.

LEGEND


CCN — Carrier Comfort Network
CPCS — Compressor Protection Control System
CXB — Compressor Expansion Board
EMM — Energy Management Module
EXV — Electronic Expansion Valve
FSM — Flotronic™ System Manager
MBB — Main Base Board
MOP — Maximum Operating Pressure
WSM — Water System Manager

*Freeze is defined as 34° F (1.1 C) for water. For brine fluids, freeze is CSP.1 –8° F (4.4 C) for single set point and lower of CSP.1/CSP.2 –8° F (4.4 C) for dual set point configuration.

NOTE: The following table shows illegal configurations:

1	Zero compressors in a circuit
2	Four compressors in a circuit with two unloaders
3	Four compressors in a circuit with one unloader and hot gas bypass
4	Two unloaders and hot gas bypass in a circuit.
5	More than one compressor quantity difference between circuits
6	Fluid type of low temperature brine
7	Air cooled head pressure control with common fan staging and different head pressure control methods for each circuit.

SERVICE

	ELECTRIC SHOCK HAZARD. Turn off all power to unit before servicing. The ENABLE/OFF/REMOTE CONTACT switch on control panel does <i>not</i> shut off control power; <i>use field disconnect</i> .
---	---

Electronic Components

CONTROL COMPONENTS — Unit uses an advanced electronic control system that normally does not require service. For details on controls refer to Operating Data section.

30GTN,R040-110, AND 230B-315B UNIT CONTROL BOX — When facing compressors, main control box is at left end of unit. All incoming power enters through main box. Control box contains power components and electronic controls.

Outer panels are hinged and latched for easy opening. Remove screws to remove inner panels. Outer panels can be held open for service and inspection by using door retainer on each panel. To use door retainers: remove bottom pin from door retainer assembly, swing retainer out horizontally, and engage pin in one of the retainer ears and the hinge assembly.

30GTN,R130-210, 230A-315A, AND 330A/B-420A/B UNIT CONTROL AND MAIN POWER BOXES — The main power box is on the cooler side of the unit, and the control box is on the compressor side. Outer panels are hinged and latched for easy opening. Remove screws to remove inner panels.

Compressors — If lead compressor on either refrigerant circuit becomes inoperative for any reason, circuit is locked off and *cannot* be operated due to features built into the electronic control system. *Do not attempt to bypass controls to force compressors to run.*

COMPRESSOR REMOVAL — Access to the pump end of the compressor is from the compressor side of the unit. Access to the motor end of the compressor is from the inside of the unit. All compressors can be removed from the compressor side of the unit.

IMPORTANT: All compressor mounting hardware and support brackets removed during servicing must be re-installed prior to start-up.

Following the installation of the new compressor:

Tighten discharge valves to —

	Compressor(s)
20 to 25 ft-lb (27 to 34 N-m)	06E250
80 to 90 ft-lb (109 to 122 N-m)	06E265,275,299

Tighten suction valves to —

80 to 90 ft-lb (109 to 122 N-m)	06E250
90 to 120 ft-lb (122 to 163 N-m)	06E265,275,299

Tighten the following fittings to —

120 in.-lb (13.5 N-m)	High-Pressure Switch
-----------------------	----------------------

OIL CHARGE (Refer to Table 28) — All units are factory charged with oil. Acceptable oil level for each compressor is from 1/8 to 3/8 of sight glass.

When additional oil or a complete charge is required, use only Carrier-approved compressor oil.

Approved oils are as follows:

Petroleum Specialties, Inc.	— Cryol 150 (factory oil charge)
Texaco, Inc.	— Capella WF-32
Witco Chemical Co.	— Suniso 3GS

Table 28 — Oil Charge

COMPRESSOR	OIL REQUIRED	
	Pts	L
06E250	14	6.6
06E265	19	9.0
06E275	19	9.0
06E299	19	9.0

Do not reuse drained oil or any oil that has been exposed to atmosphere.

Cooler — The cooler is easily accessible from the cooler side of the unit. The refrigerant feed components are accessible from the control box end of the unit.

COOLER REMOVAL — Cooler can be removed from the cooler side of the unit as follows:

⚠ CAUTION

Open and tag all electrical disconnects before any work begins. Note that cooler is heavy and both fluid-side and refrigerant-side may be under pressure.

1. To ensure the refrigerant is in the condenser, follow this procedure:

a. Open the circuit breakers and close the discharge valves for the lag compressors in both circuits.

⚠ CAUTION

Do not close the discharge valve of an operating compressor. Severe damage to the compressor can result.

b. After the lag compressor discharge service valves have been closed, close the liquid line service valve for one circuit. Allow the lead compressor to pump down that circuit until it reaches approximately 10 to 15 psig (68.8 to 103.2 kPa).

c. As soon as the system reaches that pressure, shut down the lead compressor by opening the compressor circuit breaker, then quickly close the discharge service valve for that compressor.

d. Repeat the procedure for the other circuit.

2. Close the shutoff valves, if installed, in the cooler fluid lines. Remove the cooler fluid piping.

3. Cooler may be under pressure. Open the air vent at the top of the cooler, and open the drain on the bottom of the cooler (near the leaving fluid outlet) to drain the cooler. Both the drain and the air vent are located on the leaving fluid end of cooler. See Fig. 22. Remove the cooler waterside strainer.

4. Disconnect the conduit and cooler heater wires, if equipped. Remove all thermistors from the cooler, being sure to label all thermistors as they are removed. Thermistor T1 is a well-type thermistor, and thermistor T2 is immersed directly in the fluid. See Fig. 22.

5. Remove the insulation on the refrigerant connection end of the cooler.

6. Unbolt the suction flanges from the cooler head. Save the bolts.

7. Remove the liquid lines by breaking the silver-soldered joints at the cooler liquid line nozzles.

8. On 30GTN,GTR080-110 and 230B-315B units, remove the vertical support(s) under the condenser coil in front of the cooler. *Provide temporary support as needed.* Save all screws for reinstallation later.

9. Remove the screws in the cooler feet. Slide the cooler slightly to the left to clear the refrigerant tubing. Save all screws.

Removing the cooler can be accomplished in one of 2 ways, depending on the jobsite. Either continue sliding the cooler toward the end of the unit opposite the tubing and carefully remove, or pivot the cooler and remove it from the cooler side of the unit.

REPLACING COOLER — To replace the cooler:

1. Insert new cooler carefully into place. Reattach the screws into the cooler feet (using saved screws).

On 30GTN, GTR080-110 and 230B-315B units, reattach the 2 vertical supports under the condenser coil in front of the cooler using screws saved.

2. Replace the liquid lines and solder at the cooler liquid line nozzles.
3. Rebolt the suction flanges onto the cooler head using bolts saved during removal. Use new gaskets for the suction line flanges. Use compressor oil to aid in gasket sealing and tighten the suction flange bolts to 70 to 90 ft-lb (94 to 122 N-m).

NOTE: The suction flange has a 4-bolt pattern. See Carrier specified parts for replacement part number, if necessary.

4. Using adhesive, reinstall the cooler insulation on the refrigerant connection end of the cooler.
5. Reinstall the thermistors. Refer to Thermistors section on page 57, and install as follows:
 - a. Apply pipe sealant to the 1/4-in. NPT threads on the replacement coupling for the fluid side, and install it in place of the original.

⚠ CAUTION

Do not use the packing nut to tighten the coupling. Damage to the ferrules will result.

- b. Reinstall thermistor T1 well, and insert thermistor T1 into well.

- c. Install thermistor T2 (entering fluid temperature) so that it is not touching an internal refrigerant tube, but so that it is close enough to sense a freeze condition. The recommended distance is 1/8 in. (3.2 mm) from the cooler tube. Tighten the packing nut finger tight, and then tighten 1 1/4 turns more using a back-up wrench.

6. Install the cooler heater and conduit (if equipped), connecting the wires as shown in the unit wiring schematic located on the unit.
7. Close the air vent at the top of the cooler, and close the drain on the bottom of the cooler near the leaving fluid outlet. Both the drain and the air vent are located on the leaving fluid end of the cooler. See Fig. 22.
8. Reconnect the cooler fluid piping and strainer, and open the shutoff valves (if installed). Purge the fluid of all air before starting unit.
9. Open the discharge service valves, close the circuit breakers, and open the liquid line service valves for the compressors.

SERVICING THE COOLER — When cooler heads and partition plates are removed, tube sheets are exposed showing ends of tubes.

⚠ CAUTION

Certain tubes in the 10HB coolers cannot be removed. Eight tubes in the bundle are secured inside the cooler to the baffles and *cannot be removed*. These tubes are marked by a dimple on the tube sheet. See Fig. 23. *If any of these tubes have developed a leak, plug the tube(s) as described under Tube Plugging section on page 54.*

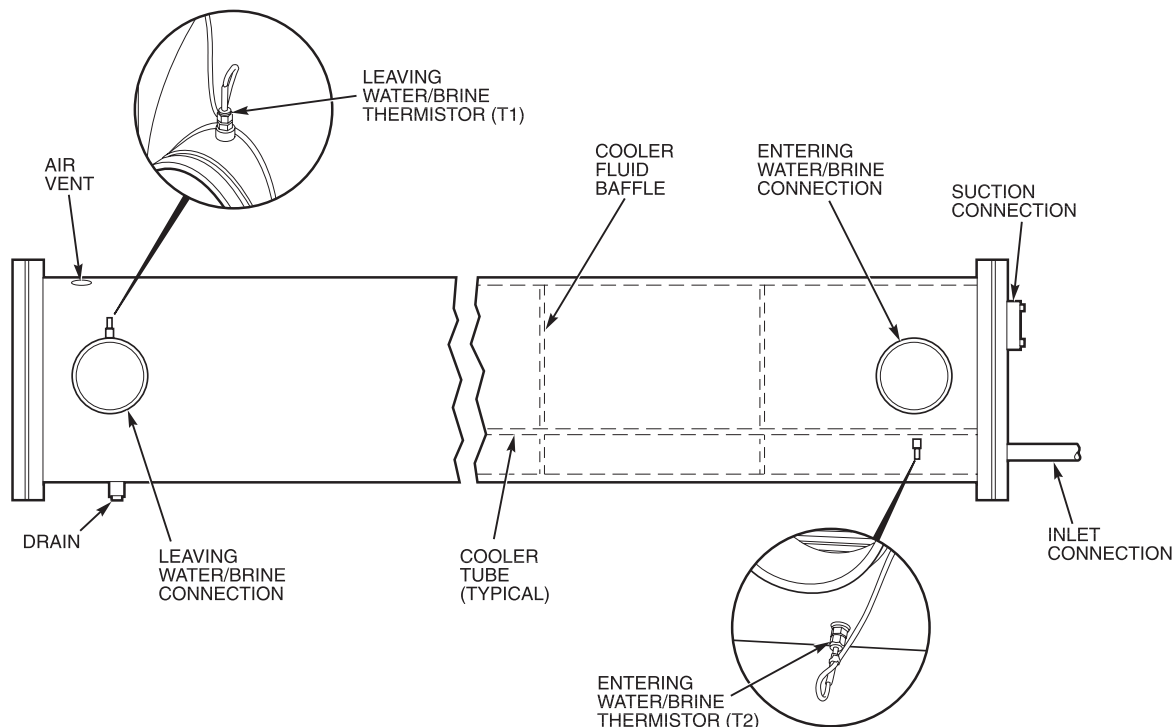


Fig. 22 — Cooler Thermistor Locations

Tube Plugging — A leaky tube can be plugged until retubing can be done. The number of tubes plugged determines how soon cooler *must* be retubed. Tubes plugged in the following locations will affect the performance of the unit: Any tube in the area, particularly the tube that thermistor T2 is adjacent to, will affect unit reliability and performance. Thermistor T2 is used in the freeze protection algorithm for the controller. If several tubes require plugging, check with your local Carrier representative to find out how number and location can affect unit capacity.

Figure 24 shows an Elliott tube plug and a cross-sectional view of a plug in place.

⚠ CAUTION

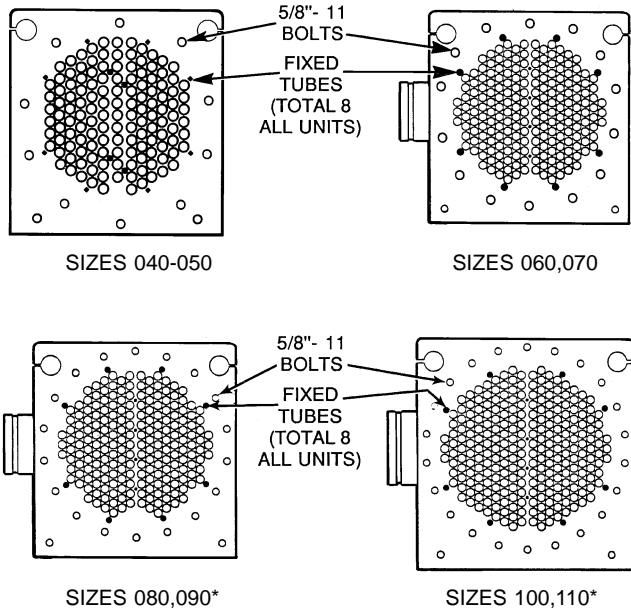
Use extreme care when installing plugs to prevent damage to the tube sheet section between the holes.

Retubing (See Table 29) — When retubing is to be done, obtain service of qualified personnel experienced in boiler maintenance and repair. Most standard procedures can be followed when retubing the 10HB coolers. An 8% crush is recommended when rolling replacement tubes into the tube sheet. An 8% crush can be achieved by setting the torque on the gun at 48 to 50 in.-lb (5.4 to 5.6 N-m).

The following Elliott Co. tube rolling tools are required:

- B3400 Expander Assembly
- B3401 Cage
- B3405 Mandrel
- B3408 Rolls

Place one drop of Loctite No. 675 or equivalent on top of tube prior to rolling. This material is intended to “wick” into the area of the tube that is not rolled into the tube sheet, and prevent fluid from accumulating between the tube and the tube sheet.



*And associated modular units (see Table 1).

Fig. 23 — Typical Tube Sheets, Cover Off (Non-Removable Tubes)

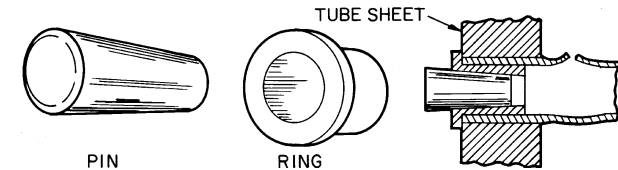


Fig. 24 — Elliott Tube Plug

Table 29 — Plugs

COMPONENTS FOR PLUGGING	PART NUMBER
For Tubes	
Brass Pin	853103-500*
Brass Ring	853002-570*
For HoleswithoutTubes	
Brass Pin	853103-1*
Brass Ring	853002-631*
Loctite	No. 675†
Locquic	“N”†

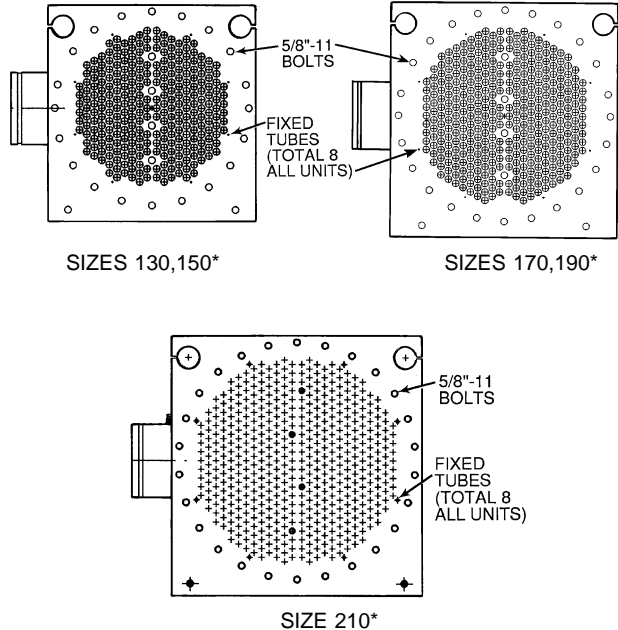
*Order directly from: Elliott Tube Company,
Dayton, Ohio

†Can be obtained locally.

Tube information follows:

	in.	mm
• Tube sheet hole diameter	0.631	16.03
• Tube OD	0.625	15.87
• Tube ID after rolling	0.581	14.76
(includes expansion due to clearance)	to 0.588	to 14.94

NOTE: Tubes next to gasket webs must be flush with tube sheet (both ends).



Tightening Cooler Head Bolts

Gasket Preparation — When reassembling cooler heads, always use new gaskets. Gaskets are neoprene-based and are brushed with a light film of compressor oil. *Do not soak gasket or gasket deterioration will result.* Use new gaskets within 30 minutes to prevent deterioration. Reassemble cooler nozzle end or plain end cover of the cooler with the gaskets. Torque all cooler bolts to the following specification and sequence:

5/8-in. Diameter Perimeter Bolts 150 to 170 ft-lb
(201 to 228 N-m)

1/2-in. Diameter Flange Bolts 70 to 90 ft-lb
(94 to 121 N-m)

1. Install all bolts finger tight.
2. Bolt tightening sequence is outlined in Fig. 25. Follow the numbering or lettering sequence so that pressure is evenly applied to gasket.
3. Apply torque in one-third steps until required torque is reached. Load *all* bolts to each one-third step before proceeding to next one-third step.
4. No less than one hour later, retighten all bolts to required torque values.
5. After refrigerant is restored to system, check for refrigerant leaks with soap solution or Halide device.
6. Replace cooler insulation.

Condenser Coils

COIL CLEANING — Clean coils with a vacuum cleaner, fresh water, compressed air, or a bristle brush (not wire). Units

installed in corrosive environments should have coil cleaning as part of a planned maintenance schedule. In this type of application, all accumulations of dirt should be cleaned off the coil.

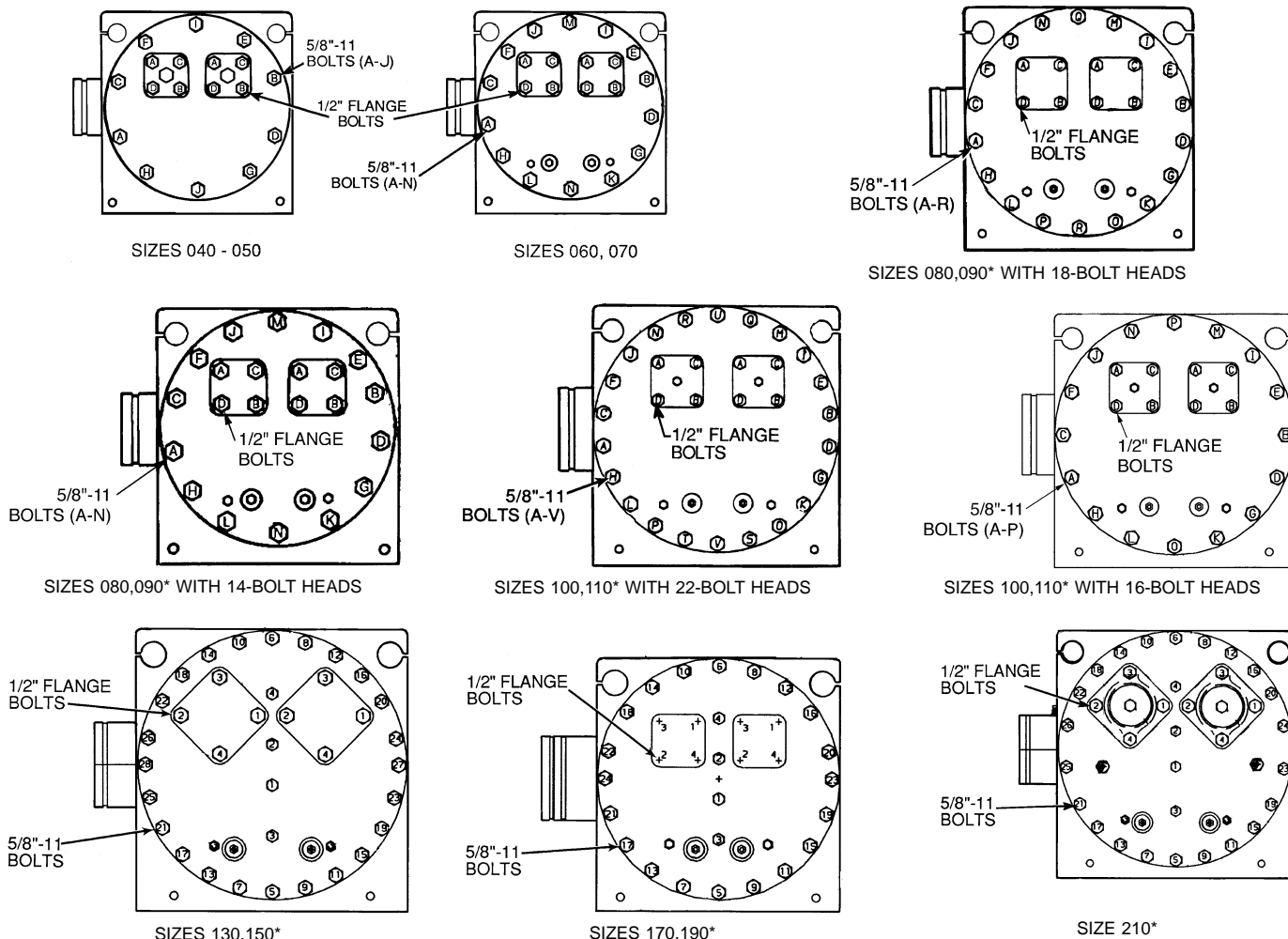
CAUTION

Do not use high-pressure water or air to clean coils — fin damage may result.

Condenser Fans — Each fan is supported by a formed wire mount bolted to fan deck and covered with a wire guard. The exposed end of fan motor shaft is protected from weather by grease. If fan motor must be removed for service or replacement, be sure to regrease fan shaft and reinstall fan guard. For proper performance, fan should be positioned as in Fig. 26A and 26B (standard and low-noise applications). Tighten setscrews to 15 ± 1 ft-lb (20 ± 1.3 N-m).

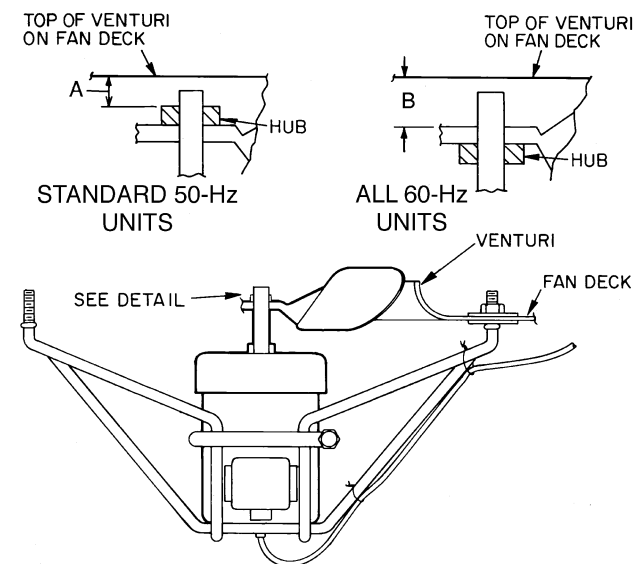
If the unit is equipped with the high-static fan option, the fan must be set from the top of the fan deck to the plastic ring or center of the fan to a distance of $2.13 \text{ in.} \pm 0.12 \text{ in.}$ ($54 \pm 3 \text{ mm}$). This is different from standard fans, since there is no area available to measure from the top of the orifice ring to the fan hub itself. See Fig. 27.

IMPORTANT: Check for proper fan rotation (clockwise viewed from above). If necessary, switch any 2 power leads to reverse fan rotation.



*And associated modular units.

Fig. 25 — Cooler Head Bolt Tightening Sequence (Typical Tube Sheet)



DIMENSION	FAN TYPE	
	Standard	Low Noise (Optional)
A	0.50" (13 mm)	1.50" (38 mm)
B	0.88" (22 mm)	1.13" (29 mm)

NOTE: Fan rotation is clockwise as viewed from top of unit.

Fig. 26A — Condenser Fan Adjustment — Standard 50 and 60 Hz Units and 60 Hz Low Noise Fan Option Units

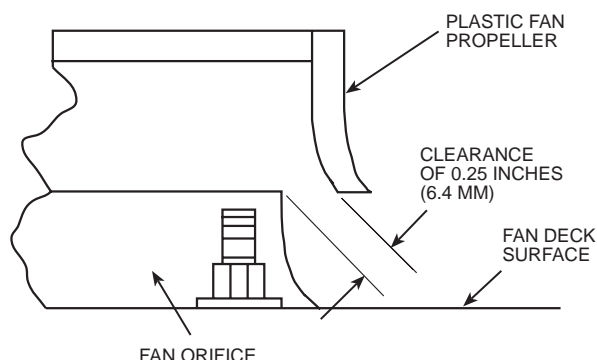
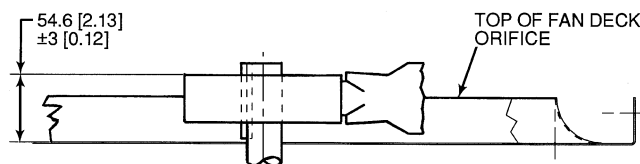


Fig. 26B — Condenser Fan Adjustment — 50 Hz Low Noise Fan Option Units



NOTE: Dimensions are in millimeters. Dimensions in [] are in inches.

Fig. 27 — Condenser Fan Adjustment, Units with High-Static Fan Option

Refrigerant Feed Components — Each circuit has all necessary refrigerant controls.

ELECTRONIC EXPANSION VALVE (EXV) — A cutaway view of valve is shown in Fig. 28.

High-pressure liquid refrigerant enters valve through bottom. A series of calibrated slots have been machined in side of orifice assembly. As refrigerant passes through orifice, pressure drops and refrigerant changes to a 2-phase condition (liquid and vapor). To control refrigerant flow for different operating conditions, a sleeve moves up and down over orifice and modulates orifice size. A sleeve is moved by a linear stepper motor. Stepper motor moves in increments and is controlled directly by EXV module. As stepper motor rotates, motion is transferred into linear movement by lead screw. Through stepper motor and lead screw, 1500 discrete steps of motion are obtained. The large number of steps and long stroke results in very accurate control of refrigerant flow. The minimum position for operation is 120 steps.

The EXV module controls the valve. The lead compressor in each circuit has a thermistor located in the suction manifold after the compressor motor and a thermistor located in a well where the refrigerant enters the cooler. The thermistors measure the temperature of the superheated gas entering the compressor cylinders and the temperature of the refrigerant entering the cooler. The difference between the temperature of the superheated gas and the cooler suction temperature is the superheat. The EXV module controls the position of the electronic expansion valve stepper motor to maintain 29 F (16 C) superheat.

The superheat leaving cooler is approximately 3° to 5° F (2° to 3° C), or less.

Because EXV status is communicated to the Main Base Board (MBB) and is controlled by the EXV modules (see Fig. 27), it is possible to track the valve position. By this means, head pressure is controlled and unit is protected against loss of charge and a faulty valve. During initial start-up, EXV is fully closed. After initialization period, valve position is tracked by the EXV module by constantly monitoring amount of valve movement.

The EXV is also used to limit cooler saturated suction temperature to 50 F (10 C). This makes it possible for the chiller to start at higher cooler fluid temperatures without overloading the compressor. This is commonly referred to as MOP (maximum operating pressure).

If it appears that EXV is not properly controlling circuit operation to maintain correct superheat, there are a number of checks that can be made using test functions and initialization features built into the microprocessor control. See Service Test section on page 29 to test EXVs.

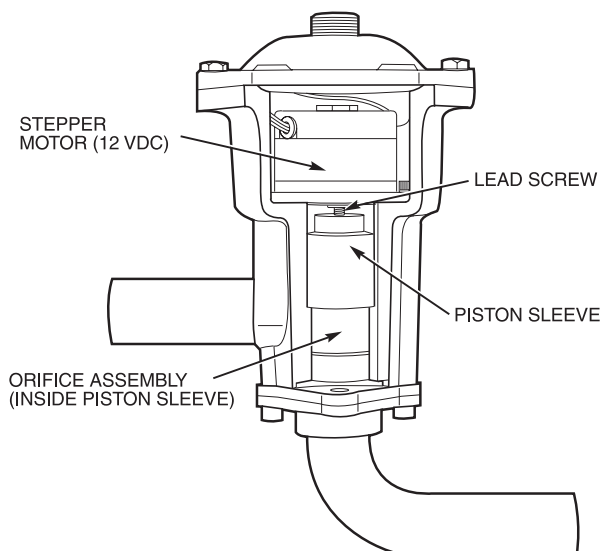


Fig. 28 — Electronic Expansion Valve (EXV)

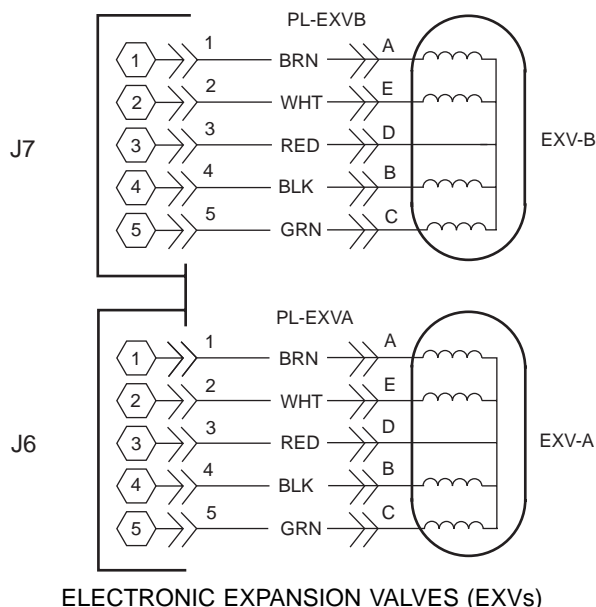


Fig. 29 — Printed Circuit Board Connector

NOTE: The EXV orifice is a screw-in type that can be removed for inspection and cleaning. Once the top cover has been removed, the EXV motor may be taken out by removing the 2 cap screws securing motor to valve body. Pull motor, lead screw, and the piston sleeve up off the orifice assembly. See Fig. 28. A slot has been cut in top of orifice assembly to facilitate removal using a large screwdriver. Turn orifice assembly counterclockwise to remove.

When cleaning or reinstalling orifice assembly, be careful not to damage orifice assembly seals. The bottom seal acts as a liquid shut-off, replacing a liquid line solenoid valve.

Reassembly of valve is made easier by screwing the piston sleeve and lead screw assembly out of the motor. Align hole in top of piston sleeve with the guide pin in orifice assembly and gently push piston sleeve and lead screw onto orifice assembly about half way. Screw motor onto lead screw and secure EXV motor with cap screws. Be careful not to twist or pull on wires from EXV motor to valve pin connections. Check EXV operation using test functions described in the Service Test section on page 29.

MOISTURE-LIQUID INDICATOR — Clear flow of liquid refrigerant indicates sufficient charge in system. Bubbles in the sight glass indicate undercharged system or presence of noncondensables. Moisture in system measured in parts per million (ppm), changes color of indicator:

Green — moisture is below 45 ppm;

Yellow-green (chartreuse) — 45 to 130 ppm (caution);

Yellow (wet) — above 130 ppm.

Change filter drier at first sign of moisture in system.

IMPORTANT: Unit must be in operation at least 12 hours before moisture indicator can give an accurate reading. With unit running, indicating element must be in contact with liquid refrigerant to give true reading.

FILTER DRIER — Whenever moisture-liquid indicator shows presence of moisture, replace filter drier(s). There is one filter drier on each circuit. Refer to Carrier Standard Service Techniques Manual, Chapter 1, Refrigerants, for details on servicing filter driers.

LIQUID LINE SOLENOID VALVE — All TXV units have a liquid line solenoid valve to prevent liquid refrigerant migration to low side of system during the off cycle.

LIQUID LINE SERVICE VALVE — This valve is located immediately ahead of filter drier, and has a 1/4-in. Schrader connection for field charging. In combination with compressor discharge service valve, each circuit can be pumped down into the high side for servicing.

Thermistors — Electronic control uses 4 to 10 thermistors to sense temperatures used to control the operation of chiller.

Thermistors T1-T9 are identical in their temperature vs resistance and voltage drop performance. Thermistor T10 is a 10 kΩ input channel and has a different set of temperature vs resistance and voltage drop performance. Resistances at various temperatures are listed in Tables 30A-31B.

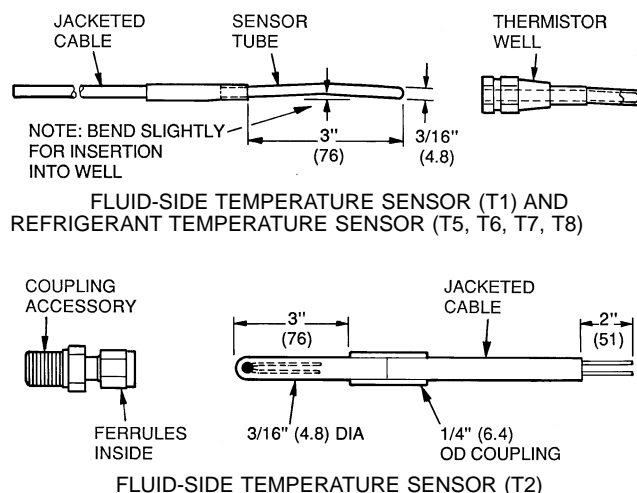
LOCATION — General locations of thermistor sensors are shown in Fig. 7-10. See Table 2 for pin connection points.

⚠ CAUTION

Sensor T2 is installed directly in the fluid circuit. Relieve all pressure or drain fluid before removing.

REPLACING THERMISTOR T2

1. Remove and discard original sensor and coupling. Do not disassemble new coupling. Install assembly as received. See Fig. 30.
2. Apply pipe sealant to 1/4-in. NPT threads on replacement coupling, and install in place of original. Do not use the packing nut to tighten coupling. Damage to ferrules will result.
3. Thermistor T2 (entering fluid temperature) should not be touching an internal refrigerant tube, but should be close enough to sense a freeze condition. Recommended distance is 1/8 in. (3.2 mm) from cooler tube. Tighten packing nut finger tight to position ferrules, then tighten 1 1/4 turns more using a back-up wrench. Ferrules are now attached to the sensor, which can be withdrawn from coupling for service.



NOTE: Dimensions in () are in millimeters.

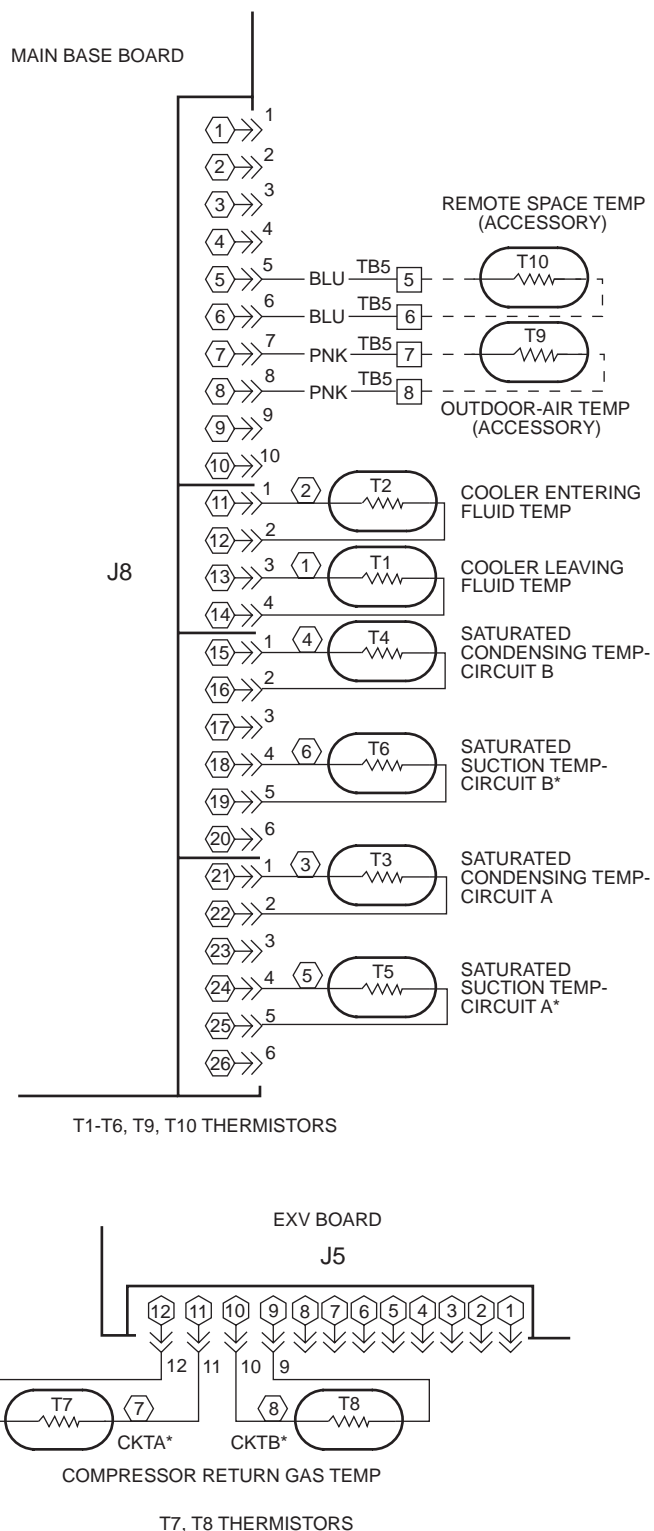
Fig. 30 — Thermistors (Temperature Sensors)

REPLACING THERMISTORS T1, T5, T6, T7, AND T8 — Add a small amount of thermal conductive grease to thermistor well. Thermistors are friction-fit thermistors, which must be slipped into receivers located in the cooler leaving fluid nozzle for T1, in the cooler head for T5 and T6 (EXV units only), and in the compressor pump end for T7 and T8 (EXV units only).

THERMISTORS T3 AND T4 — These thermistors are located on header end of condenser coil. They are clamped on a return bend.

THERMISTOR/TEMPERATURE SENSOR CHECK — A high quality digital volt-ohmmeter is required to perform this check.

1. Connect the digital voltmeter across the appropriate thermistor terminals at the J8 terminal strip on the Main Base Board for thermistors T1-T6, T9, T10; or the J5 terminal strip on the EXV Board for thermistors T7 and T8 (see Fig. 31). Using the voltage reading obtained, read the sensor temperature from Tables 30A-31B. To check thermistor accuracy, measure temperature at probe location with an accurate thermocouple-type temperature measuring instrument. Insulate thermocouple to avoid ambient temperatures from influencing reading. Temperature measured by thermocouple and temperature determined from thermistor voltage reading should be close, $\pm 5^{\circ}\text{F}$ (3°C) if care was taken in applying thermocouple and taking readings.
2. If a more accurate check is required, unit must be shut down and thermistor removed and checked at a known temperature (freezing point or boiling point of water) using either voltage drop measured across thermistor at the J8 or J5 terminals, by determining the resistance with chiller shut down and thermistor disconnected from J8 or J5. Compare the values determined with the value read by the control in the Temperatures mode using the Marquee display.



*Not used on FIOP (Factory-Installed Option) unit with TXV (Thermostatic Expansion Valve).

Fig. 31 — Thermistor Connections to J5 and J8 Processor Boards

**Table 30A — 5K Thermistor Temperatures (°F) vs Resistance/Voltage Drop
(For Thermistors T1-T9)**

TEMP (F)	VOLTAGE DROP (V)	RESISTANCE (Ohms)	TEMP (F)	VOLTAGE DROP (V)	RESISTANCE (Ohms)	TEMP (F)	VOLTAGE DROP (V)	RESISTANCE (Ohms)
-25	4.538	98,010	59	2.200	7,868	143	0.525	1,190
-24	4.523	94,707	60	2.168	7,665	144	0.515	1,165
-23	4.508	91,522	61	2.137	7,468	145	0.506	1,141
-22	4.493	88,449	62	2.105	7,277	146	0.497	1,118
-21	4.476	85,486	63	2.074	7,091	147	0.489	1,095
-20	4.460	82,627	64	2.043	6,911	148	0.480	1,072
-19	4.444	79,871	65	2.013	6,735	149	0.471	1,050
-18	4.427	77,212	66	1.982	6,564	150	0.463	1,029
-17	4.409	74,648	67	1.952	6,399	151	0.455	1,007
-16	4.391	72,175	68	1.923	6,238	152	0.447	986
-15	4.373	69,790	69	1.893	6,081	153	0.440	965
-14	4.354	67,490	70	1.864	5,929	154	0.432	945
-13	4.335	65,272	71	1.835	5,781	155	0.424	925
-12	4.316	63,133	72	1.806	5,637	156	0.417	906
-11	4.296	61,070	73	1.778	5,497	157	0.410	887
-10	4.276	59,081	74	1.749	5,361	158	0.403	868
-9	4.255	57,162	75	1.722	5,229	159	0.396	850
-8	4.234	55,311	76	1.694	5,101	160	0.389	832
-7	4.213	53,526	77	1.667	4,976	161	0.382	815
-6	4.191	51,804	78	1.640	4,855	162	0.376	798
-5	4.169	50,143	79	1.613	4,737	163	0.369	782
-4	4.146	48,541	80	1.587	4,622	164	0.363	765
-3	4.123	46,996	81	1.561	4,511	165	0.357	750
-2	4.100	45,505	82	1.535	4,403	166	0.351	734
-1	4.076	44,066	83	1.510	4,298	167	0.345	719
0	4.052	42,679	84	1.485	4,196	168	0.339	705
1	4.027	41,339	85	1.460	4,096	169	0.333	690
2	4.002	40,047	86	1.436	4,000	170	0.327	677
3	3.976	38,800	87	1.412	3,906	171	0.322	663
4	3.951	37,596	88	1.388	3,814	172	0.316	650
5	3.924	36,435	89	1.365	3,726	173	0.311	638
6	3.898	35,313	90	1.342	3,640	174	0.306	626
7	3.871	34,231	91	1.319	3,556	175	0.301	614
8	3.844	33,185	92	1.296	3,474	176	0.295	602
9	3.816	32,176	93	1.274	3,395	177	0.291	591
10	3.788	31,202	94	1.253	3,318	178	0.286	581
11	3.760	30,260	95	1.231	3,243	179	0.281	570
12	3.731	29,351	96	1.210	3,170	180	0.276	561
13	3.702	28,473	97	1.189	3,099	181	0.272	551
14	3.673	27,624	98	1.169	3,031	182	0.267	542
15	3.643	26,804	99	1.148	2,964	183	0.263	533
16	3.613	26,011	100	1.128	2,898	184	0.258	524
17	3.583	25,245	101	1.109	2,835	185	0.254	516
18	3.552	24,505	102	1.089	2,773	186	0.250	508
19	3.522	23,789	103	1.070	2,713	187	0.246	501
20	3.490	23,096	104	1.051	2,655	188	0.242	494
21	3.459	22,427	105	1.033	2,597	189	0.238	487
22	3.428	21,779	106	1.015	2,542	190	0.234	480
23	3.396	21,153	107	0.997	2,488	191	0.230	473
24	3.364	20,547	108	0.980	2,436	192	0.226	467
25	3.331	19,960	109	0.963	2,385	193	0.223	461
26	3.299	19,393	110	0.946	2,335	194	0.219	456
27	3.266	18,843	111	0.929	2,286	195	0.216	450
28	3.234	18,311	112	0.913	2,239	196	0.212	445
29	3.201	17,796	113	0.896	2,192	197	0.209	439
30	3.168	17,297	114	0.881	2,147	198	0.205	434
31	3.134	16,814	115	0.865	2,103	199	0.202	429
32	3.101	16,346	116	0.850	2,060	200	0.199	424
33	3.068	15,892	117	0.835	2,018	201	0.196	419
34	3.034	15,453	118	0.820	1,977	202	0.192	415
35	3.000	15,027	119	0.805	1,937	203	0.189	410
36	2.966	14,614	120	0.791	1,898	204	0.186	405
37	2.933	14,214	121	0.777	1,860	205	0.183	401
38	2.899	13,826	122	0.763	1,822	206	0.181	396
39	2.865	13,449	123	0.750	1,786	207	0.178	391
40	2.831	13,084	124	0.736	1,750	208	0.175	386
41	2.797	12,730	125	0.723	1,715	209	0.172	382
42	2.764	12,387	126	0.710	1,680	210	0.169	377
43	2.730	12,053	127	0.698	1,647	211	0.167	372
44	2.696	11,730	128	0.685	1,614	212	0.164	367
45	2.662	11,416	129	0.673	1,582	213	0.162	361
46	2.628	11,112	130	0.661	1,550	214	0.159	356
47	2.594	10,816	131	0.650	1,519	215	0.157	350
48	2.561	10,529	132	0.638	1,489	216	0.154	344
49	2.527	10,250	133	0.627	1,459	217	0.152	338
50	2.494	9,979	134	0.616	1,430	218	0.150	332
51	2.461	9,717	135	0.605	1,401	219	0.147	325
52	2.427	9,461	136	0.594	1,373	220	0.145	318
53	2.395	9,213	137	0.584	1,345	221	0.143	311
54	2.362	8,973	138	0.573	1,318	222	0.141	304
55	2.329	8,739	139	0.563	1,291	223	0.138	297
56	2.296	8,511	140	0.553	1,265	224	0.136	289
57	2.264	8,291	141	0.543	1,240	225	0.134	282
58	2.232	8,076	142	0.534	1,214			

**Table 30B — 5K Thermistor Temperatures (°C) vs Resistance/Voltage Drop
(For Thermistors T1-T9)**

TEMP (C)	VOLTAGE DROP (V)	RESISTANCE (Ohms)	TEMP (C)	VOLTAGE DROP (V)	RESISTANCE (Ohms)	TEMP (C)	VOLTAGE DROP (V)	RESISTANCE (Ohms)
-32	4.547	100 260	16	2.143	7 499	64	0.487	1 079
-31	4.520	94 165	17	2.087	7 161	65	0.471	1 041
-30	4.493	88 480	18	2.031	6 840	66	0.457	1 006
-29	4.464	83 170	19	1.976	6 536	67	0.443	971
-28	4.433	78 125	20	1.923	6 246	68	0.429	938
-27	4.402	73 580	21	1.870	5 971	69	0.415	906
-26	4.369	69 250	22	1.817	5 710	70	0.403	876
-25	4.335	65 205	23	1.766	5 461	71	0.390	836
-24	4.300	61 420	24	1.716	5 225	72	0.378	805
-23	4.264	57 875	25	1.667	5 000	73	0.367	775
-22	4.226	54 555	26	1.619	4 786	74	0.355	747
-21	4.187	51 450	27	1.571	4 583	75	0.345	719
-20	4.146	48 536	28	1.525	4 389	76	0.334	693
-19	4.104	45 807	29	1.480	4 204	77	0.324	669
-18	4.061	43 247	30	1.436	4 028	78	0.314	645
-17	4.017	40 845	31	1.393	3 861	79	0.305	623
-16	3.971	38 592	32	1.351	3 701	80	0.295	602
-15	3.924	38 476	33	1.310	3 549	81	0.287	583
-14	3.876	34 489	34	1.270	3 404	82	0.278	564
-13	3.827	32 621	35	1.231	3 266	83	0.270	547
-12	3.777	30 866	36	1.193	3 134	84	0.262	531
-11	3.725	29 216	37	1.156	3 008	85	0.254	516
-10	3.673	27 633	38	1.120	2 888	86	0.247	502
-9	3.619	26 202	39	1.085	2 773	87	0.239	489
-8	3.564	24 827	40	1.051	2 663	88	0.232	477
-7	3.509	23 532	41	1.019	2 559	89	0.226	466
-6	3.453	22 313	42	0.987	2 459	90	0.219	456
-5	3.396	21 163	43	0.956	2 363	91	0.213	446
-4	3.338	20 079	44	0.926	2 272	92	0.207	436
-3	3.279	19 058	45	0.896	2 184	93	0.201	427
-2	3.221	18 094	46	0.868	2 101	94	0.195	419
-1	3.161	17 184	47	0.841	2 021	95	0.189	410
0	3.101	16 325	48	0.814	1 944	96	0.184	402
1	3.041	15 515	49	0.788	1 871	97	0.179	393
2	2.980	14 749	50	0.763	1 801	98	0.174	385
3	2.919	14 026	51	0.739	1 734	99	0.169	376
4	2.858	13 342	52	0.716	1 670	100	0.164	367
5	2.797	12 696	53	0.693	1 609	101	0.160	357
6	2.737	12 085	54	0.671	1 550	102	0.155	346
7	2.675	11 506	55	0.650	1 493	103	0.151	335
8	2.615	10 959	56	0.629	1 439	104	0.147	324
9	2.554	10 441	57	0.609	1 387	105	0.143	312
10	2.494	9 949	58	0.590	1 337	106	0.139	299
11	2.434	9 485	59	0.571	1 290	107	0.135	285
12	2.375	9 044	60	0.553	1 244			
13	2.316	8 627	61	0.536	1 200			
14	2.258	8 231	62	0.519	1 158			
15	2.200	7 855	63	0.502	1 118			

**Table 31A — 10K Thermistor Temperatures (°F) vs Resistance/Voltage Drop
(For Thermistor T10)**

TEMP (F)	VOLTAGE DROP (V)	RESISTANCE (Ohms)	TEMP (F)	VOLTAGE DROP (V)	RESISTANCE (Ohms)	TEMP (F)	VOLTAGE DROP (V)	RESISTANCE (Ohms)
-25	4.758	196,453	61	2.994	14,925	147	0.890	2,166
-24	4.750	189,692	62	2.963	14,549	148	0.876	2,124
-23	4.741	183,300	63	2.932	14,180	149	0.862	2,083
-22	4.733	177,000	64	2.901	13,824	150	0.848	2,043
-21	4.724	171,079	65	2.870	13,478	151	0.835	2,003
-20	4.715	165,238	66	2.839	13,139	152	0.821	1,966
-19	4.705	159,717	67	2.808	12,814	153	0.808	1,928
-18	4.696	154,344	68	2.777	12,493	154	0.795	1,891
-17	4.686	149,194	69	2.746	12,187	155	0.782	1,855
-16	4.676	144,250	70	2.715	11,884	156	0.770	1,820
-15	4.665	139,443	71	2.684	11,593	157	0.758	1,786
-14	4.655	134,891	72	2.653	11,308	158	0.745	1,752
-13	4.644	130,402	73	2.622	11,031	159	0.733	1,719
-12	4.633	126,183	74	2.592	10,764	160	0.722	1,687
-11	4.621	122,018	75	2.561	10,501	161	0.710	1,656
-10	4.609	118,076	76	2.530	10,249	162	0.699	1,625
-9	4.597	114,236	77	2.500	10,000	163	0.687	1,594
-8	4.585	110,549	78	2.470	9,762	164	0.676	1,565
-7	4.572	107,006	79	2.439	9,526	165	0.666	1,536
-6	4.560	103,558	80	2.409	9,300	166	0.655	1,508
-5	4.546	100,287	81	2.379	9,078	167	0.645	1,480
-4	4.533	97,060	82	2.349	8,862	168	0.634	1,453
-3	4.519	94,020	83	2.319	8,653	169	0.624	1,426
-2	4.505	91,019	84	2.290	8,448	170	0.614	1,400
-1	4.490	88,171	85	2.260	8,251	171	0.604	1,375
0	4.476	85,396	86	2.231	8,056	172	0.595	1,350
1	4.461	82,729	87	2.202	7,869	173	0.585	1,326
2	4.445	80,162	88	2.173	7,685	174	0.576	1,302
3	4.429	77,662	89	2.144	7,507	175	0.567	1,278
4	4.413	75,286	90	2.115	7,333	176	0.558	1,255
5	4.397	72,940	91	2.087	7,165	177	0.549	1,233
6	4.380	70,727	92	2.059	6,999	178	0.540	1,211
7	4.363	68,542	93	2.030	6,838	179	0.532	1,190
8	4.346	66,465	94	2.003	6,683	180	0.523	1,169
9	4.328	64,439	95	1.975	6,530	181	0.515	1,148
10	4.310	62,491	96	1.948	6,383	182	0.507	1,128
11	4.292	60,612	97	1.921	6,238	183	0.499	1,108
12	4.273	58,781	98	1.894	6,098	184	0.491	1,089
13	4.254	57,039	99	1.867	5,961	185	0.483	1,070
14	4.235	55,319	100	1.841	5,827	186	0.476	1,052
15	4.215	53,693	101	1.815	5,698	187	0.468	1,033
16	4.195	52,086	102	1.789	5,571	188	0.461	1,016
17	4.174	50,557	103	1.763	5,449	189	0.454	998
18	4.153	49,065	104	1.738	5,327	190	0.447	981
19	4.132	47,627	105	1.713	5,210	191	0.440	964
20	4.111	46,240	106	1.688	5,095	192	0.433	947
21	4.089	44,888	107	1.663	4,984	193	0.426	931
22	4.067	43,598	108	1.639	4,876	194	0.419	915
23	4.044	42,324	109	1.615	4,769	195	0.413	900
24	4.021	41,118	110	1.591	4,666	196	0.407	885
25	3.998	39,926	111	1.567	4,564	197	0.400	870
26	3.975	38,790	112	1.544	4,467	198	0.394	855
27	3.951	37,681	113	1.521	4,370	199	0.388	841
28	3.927	36,610	114	1.498	4,277	200	0.382	827
29	3.903	35,577	115	1.475	4,185	201	0.376	814
30	3.878	34,569	116	1.453	4,096	202	0.370	800
31	3.853	33,606	117	1.431	4,008	203	0.365	787
32	3.828	32,654	118	1.409	3,923	204	0.359	774
33	3.802	31,752	119	1.387	3,840	205	0.354	762
34	3.776	30,860	120	1.366	3,759	206	0.349	749
35	3.750	30,009	121	1.345	3,681	207	0.343	737
36	3.723	29,177	122	1.324	3,603	208	0.338	725
37	3.697	28,373	123	1.304	3,529	209	0.333	714
38	3.670	27,597	124	1.284	3,455	210	0.328	702
39	3.654	26,838	125	1.264	3,383	211	0.323	691
40	3.615	26,113	126	1.244	3,313	212	0.318	680
41	3.587	25,396	127	1.225	3,244	213	0.314	670
42	3.559	24,715	128	1.206	3,178	214	0.309	659
43	3.531	24,042	129	1.187	3,112	215	0.305	649
44	3.503	23,399	130	1.168	3,049	216	0.300	639
45	3.474	22,770	131	1.150	2,986	217	0.296	629
46	3.445	22,161	132	1.132	2,926	218	0.292	620
47	3.416	21,573	133	1.114	2,866	219	0.288	610
48	3.387	20,998	134	1.096	2,809	220	0.284	601
49	3.357	20,447	135	1.079	2,752	221	0.279	592
50	3.328	19,903	136	1.062	2,697	222	0.275	583
51	3.298	19,386	137	1.045	2,643	223	0.272	574
52	3.268	18,874	138	1.028	2,590	224	0.268	566
53	3.238	18,384	139	1.012	2,539	225	0.264	557
54	3.208	17,904	140	0.996	2,488			
55	3.178	17,441	141	0.980	2,439			
56	3.147	16,991	142	0.965	2,391			
57	3.117	16,552	143	0.949	2,343			
58	3.086	16,131	144	0.934	2,297			
59	3.056	15,714	145	0.919	2,253			
60	3.025	15,317	146	0.905	2,209			

**Table 31B — 10K Thermistor Temperatures (°C) vs Resistance/Voltage Drop
(For Thermistor T10)**

TEMP (F)	VOLTAGE DROP (V)	RESISTANCE (Ohms)	TEMP (F)	VOLTAGE DROP (V)	RESISTANCE (Ohms)	TEMP (F)	VOLTAGE DROP (V)	RESISTANCE (Ohms)
-32	4.762	200,510	15	3.056	15,714	62	0.940	2,315
-31	4.748	188,340	16	3.000	15,000	63	0.913	2,235
-30	4.733	177,000	17	2.944	14,323	64	0.887	2,157
-29	4.716	166,342	18	2.889	13,681	65	0.862	2,083
-28	4.700	156,404	19	2.833	13,071	66	0.837	2,011
-27	4.682	147,134	20	2.777	12,493	67	0.813	1,943
-26	4.663	138,482	21	2.721	11,942	68	0.790	1,876
-25	4.644	130,402	22	2.666	11,418	69	0.767	1,813
-24	4.624	122,807	23	2.610	10,921	70	0.745	1,752
-23	4.602	115,710	24	2.555	10,449	71	0.724	1,693
-22	4.580	109,075	25	2.500	10,000	72	0.703	1,637
-21	4.557	102,868	26	2.445	9,571	73	0.683	1,582
-20	4.533	97,060	27	2.391	9,164	74	0.663	1,530
-19	4.508	91,588	28	2.337	8,776	75	0.645	1,480
-18	4.482	86,463	29	2.284	8,407	76	0.626	1,431
-17	4.455	81,662	30	2.231	8,056	77	0.608	1,385
-16	4.426	77,162	31	2.178	7,720	78	0.591	1,340
-15	4.397	72,940	32	2.127	7,401	79	0.574	1,297
-14	4.367	68,957	33	2.075	7,096	80	0.558	1,255
-13	4.335	65,219	34	2.025	6,806	81	0.542	1,215
-12	4.303	61,711	35	1.975	6,530	82	0.527	1,177
-11	4.269	58,415	36	1.926	6,266	83	0.512	1,140
-10	4.235	55,319	37	1.878	6,014	84	0.497	1,104
-9	4.199	52,392	38	1.830	5,774	85	0.483	1,070
-8	4.162	49,640	39	1.784	5,546	86	0.470	1,037
-7	4.124	47,052	40	1.738	5,327	87	0.457	1,005
-6	4.085	44,617	41	1.692	5,117	88	0.444	974
-5	4.044	42,324	42	1.648	4,918	89	0.431	944
-4	4.003	40,153	43	1.605	4,727	90	0.419	915
-3	3.961	38,109	44	1.562	4,544	91	0.408	889
-2	3.917	36,182	45	1.521	4,370	92	0.396	861
-1	3.873	34,367	46	1.480	4,203	93	0.386	836
0	3.828	32,654	47	1.439	4,042	94	0.375	811
1	3.781	31,030	48	1.400	3,889	95	0.365	787
2	3.734	29,498	49	1.362	3,743	96	0.355	764
3	3.686	28,052	50	1.324	3,603	97	0.345	742
4	3.637	26,686	51	1.288	3,469	98	0.336	721
5	3.587	25,396	52	1.252	3,340	99	0.327	700
6	3.537	24,171	53	1.217	3,217	100	0.318	680
7	3.485	23,013	54	1.183	3,099	101	0.310	661
8	3.433	21,918	55	1.150	2,986	102	0.302	643
9	3.381	20,883	56	1.117	2,878	103	0.294	626
10	3.328	19,903	57	1.086	2,774	104	0.287	609
11	3.274	18,972	58	1.055	2,675	105	0.279	592
12	3.220	18,090	59	1.025	2,579	106	0.272	576
13	3.165	17,255	60	0.996	2,488	107	0.265	561
14	3.111	16,464	61	0.968	2,400			

Safety Devices — Chillers contain many safety devices and protection logic built into electronic control. Following is a brief summary of major safeties.

COMPRESSOR PROTECTION

Circuit Breaker — One manual-reset, calibrated-trip magnetic circuit breaker for each compressor protects against over-current. Do not bypass or increase size of a breaker to correct problems. Determine cause for trouble and correct before resetting breaker. Circuit breaker must-trip amps (MTA) are listed on individual circuit breakers, and on unit label diagrams.

30GTN,R070 (50 Hz), 080-110 and 230B-315B Compressor Protection Board (CPCS) — The CPCS is used to control and protect compressors and crankcase heaters. Board provides following features:

- compressor contactor control
- crankcase heater control
- ground current protection
- status communication to processor board
- high-pressure protection

One large relay is located on CPCS board that controls crankcase heater and compressor contactor. In addition, this relay provides a set of contacts that the microprocessor monitors to determine operating status of compressor. If the MBB determines that compressor is not operating properly through signal contacts, control locks compressor off.

The CPCS contains logic that can detect if current-to-ground of any winding exceeds 2.5 amps; if so, compressor shuts down.

A high-pressure switch with a trip pressure of 426 ± 7 psig (2936 ± 48 kPa) is mounted on each compressor; switch setting is shown in Table 32. Switch is wired in series with the CPCS. If switch opens, CPCS relay opens, processor detects it through signal contacts, and compressor locks off. A loss-of-charge switch is also wired in series with the high-pressure switch and CPCS.

If any of these switches opens during operation, the compressor stops and the failure is detected by the MBB when signal contacts open. If lead compressor in either circuit is shut down by high-pressure switch, ground current protector, loss of charge switch, or oil pressure switch, all compressors in the circuit are locked off.

30GTN,R130-210, 230A-315A AND 330A/B-420A/B — A control relay in conjunction with a ground fault module replaces the function of the CPCS (above). To reset, press the push-button switch near the Marquee display).

Table 32 — Pressure Switch Settings, psig (kPa)

SWITCH	CUTOUT	CUT-IN
High Pressure	426 ± 7 (2936 \pm 48)	320 ± 20 (2205 \pm 138)
Loss-of-Charge	7 (48.2)	22 (151.6)

LOW OIL PRESSURE PROTECTION — Lead compressor in each circuit is equipped with a switch to detect low oil pressure. Switch is connected directly to processor board. Switch is set to open at approximately 5 psig (35 kPa) and to close at 9 psig (62 kPa) maximum. If switch opens when compressor is running, CR or processor board stops all compressors in circuit. During start-up, switch is bypassed for 2 minutes.

CRANKCASE HEATERS — Each compressor has a 180-w crankcase heater to prevent absorption of liquid refrigerant by oil in crankcase when compressor is not running. Heater power source is auxiliary control power, independent of main unit power. This assures compressor protection even when main unit power disconnect switch is off.

IMPORTANT: Never open any switch or disconnect that deenergizes crankcase heaters unless unit is being serviced or is to be shut down for a prolonged period. After a prolonged shutdown or service, energize crankcase heaters for 24 hours before starting unit.

COOLER PROTECTION

Freeze Protection — Cooler can be wrapped with heater cables as shown in Fig. 32, which are wired through an ambient temperature switch set at 36 F (2 C). Entire cooler is covered with closed-cell insulation applied over heater cables. Heaters plus insulation protect cooler against low ambient temperature freeze-up to 0° F (–18 C).

IMPORTANT: If unit is installed in an area where ambient temperatures fall below 32 F (0° C), it is recommended that inhibited ethylene glycol or other suitable corrosion-inhibitive antifreeze solution be used in chilled-liquid circuit.

Low Fluid Temperature — Main Base Board is programmed to shut chiller down if leaving fluid temperature drops below 34 F (1.1 C) for water or more than 8° F (4.4° C) below set point for brine units. The unit will shut down without a pumpout. When fluid temperature rises to 6° F (3.3° C) above leaving fluid set point, safety resets and chiller restarts. Reset is automatic as long as this is the first occurrence.

Loss of Fluid Flow Protection — Main Base Board contains internal logic that protects cooler against loss of cooler flow. Entering and leaving fluid temperature sensors in cooler detect a no-flow condition. Leaving sensor is located in leaving fluid nozzle and entering sensor is located in first cooler baffle space in close proximity to cooler tubes, as shown in Fig. 20. When there is no cooler flow and the compressors start, leaving fluid temperature does not change. However, entering fluid temperature drops rapidly as refrigerant enters cooler through EXV. Entering sensor detects this temperature drop and when entering temperature is 3° F (1.6° C) below leaving temperature, unit stops and is locked off.

Loss-of-Charge — A pressure switch connected to high side of each refrigerant circuit protects against total loss-of-charge. Switch settings are listed in Table 32. If switch is open, unit cannot start; if it opens during operation, unit locks out and cannot restart until switch is closed. Low charge is also monitored by the processor when an EXV is used. The loss-of-charge switch is wired in series with the high-pressure switch on each circuit's lead compressor.

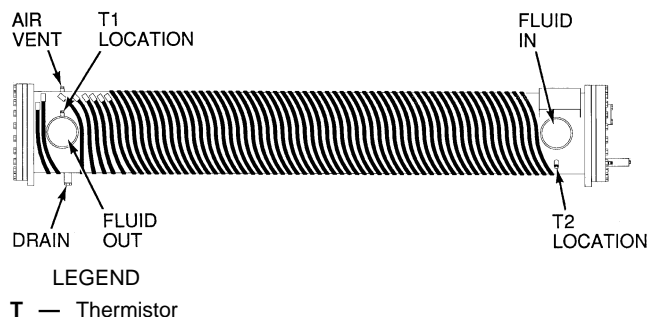


Fig. 32 — Cooler Heater Cables

Relief Devices — Fusible plugs are located in each circuit to protect against damage from excessive pressures.

HIGH-SIDE PROTECTION — One device is located between condenser and filter drier; a second is on filter drier. These are both designed to relieve pressure on a temperature rise to approximately 210 F (99 C).

LOW-SIDE PROTECTION — A device is located on suction line and is designed to relieve pressure on a temperature rise to approximately 170 F (77 C).

PRESSURE RELIEF VALVES (208/230, 460, 575 v; 60 Hz Units Only) — Valves are installed in each circuit (one per circuit). The valves are designed to relieve at 450 psig (3103 kPa). *These valves should not be capped.* If a valve relieves, it should be replaced. If valve is not replaced, it may relieve at a lower pressure, or leak due to trapped dirt from the system which may prevent resealing.

The pressure relief valves are equipped with a 3/8-in. SAE flare for field connection. Some local building codes require that relieved gases be removed. This connection will allow conformance to this requirement.

Other Safeties — There are several other safeties that are provided by microprocessor control. For details refer to Alarms and Alerts section on page 47.

PRE-START-UP

IMPORTANT: Before beginning Pre-Start-Up or Start-Up, complete Start-Up Checklist for ComfortLink™ Chiller Systems at end of this publication (page CL-1). The Checklist assures proper start-up of a unit, and provides a record of unit condition, application requirements, system information, and operation at initial start-up.

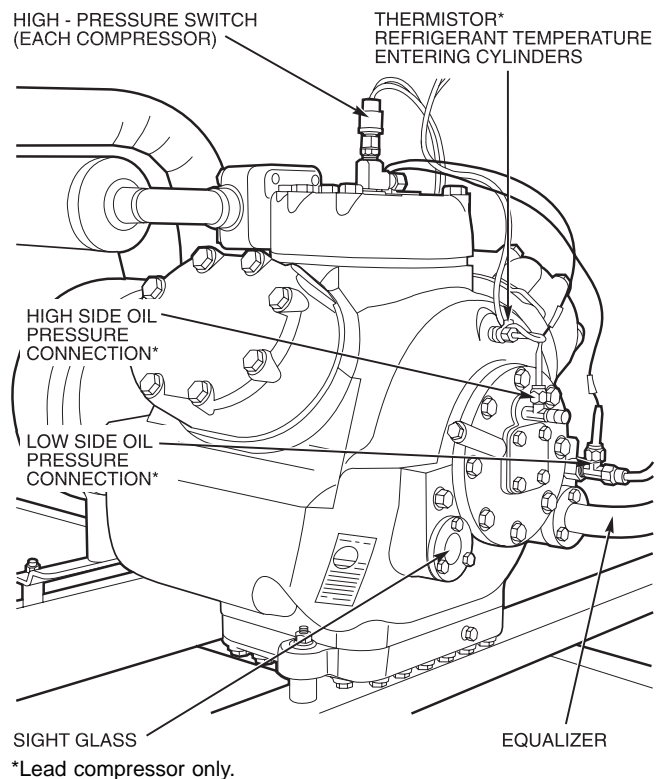
Do not attempt to start the chiller until following checks have been completed.

System Check

1. Check all auxiliary components, such as the chilled fluid circulating pump, air-handling equipment, or other equipment to which the chiller supplies liquid. Consult manufacturer's instructions. If the unit has field-installed accessories, be sure all are properly installed and wired correctly. Refer to unit wiring diagrams.
2. Backseat (open) compressor suction and discharge shut-off valves. Close valves one turn to allow refrigerant pressure to reach the test gages.
3. Open liquid line service valves.
4. Fill the chiller fluid circuit with clean water (with recommended inhibitor added) or other noncorrosive fluid to be cooled. Bleed all air out of high points of system. An air vent is included with the cooler. If outdoor temperatures are expected to be below 32 F

(0° C), sufficient inhibited ethylene glycol or other suitable corrosion-inhibited antifreeze should be added to the chiller water circuit to prevent possible freeze-up.

5. Check tightness of all electrical connections.
6. Oil should be visible in the compressor sight glass. See Fig. 31. An acceptable oil level in the compressor is from 1/8 to 3/8 of sight glass. Adjust the oil level as required. No oil should be removed unless the crankcase heater has been energized for at least 24 hours. See Oil Charge section on page 52 for Carrier-approved oils.
7. Electrical power source must agree with unit nameplate.
8. *Crankcase heaters must be firmly locked into compressors, and must be on for 24 hours prior to start-up.*
9. Fan motors are 3 phase. Check rotation of fans during the service test. Fan rotation is clockwise as viewed from top of unit. If fan is not turning clockwise, reverse 2 of the power wires. For low noise fan option on 50 Hz chillers, fans rotate counterclockwise as viewed from top of unit. If fan is not turning counterclockwise, reverse 2 of the power wires.
10. Check compressor suspension. Mounting rails must be floating freely on the springs.
11. Perform service test to verify proper settings.



**Fig. 33 — Compressor Connections
(Lead Compressor Shown)**

START-UP AND OPERATION

NOTE: Refer to Start-Up Checklist on pages CL-1 to CL-8.

Actual Start-Up — *Actual start-up should be done only under supervision of a qualified refrigeration mechanic.*

1. Be sure all service valves are open. Units are shipped from factory with suction, discharge, and liquid line service valves closed.
2. Using the Marquee display, set leaving-fluid set point (CSP.1 is Set Point mode under sub-mode COOL). No cooling range adjustment is necessary.
3. If optional control functions or accessories are being used, the unit must be properly configured. Refer to Operating Data section for details.
4. Start chilled fluid pump.
5. Turn ENABLE/OFF/REMOTE CONTACT switch to ENABLE position.
6. Allow unit to operate and confirm that everything is functioning properly. Check to see that leaving fluid temperature agrees with leaving set point (CSP.1 or CSP.2), or if reset is used, with the control point (CTPT) in the Run Status mode under the sub-mode VIEW.

Operating Limitations

TEMPERATURES (See Table 33) — If unit is to be used in an area with high solar radiation, mounted position should be such that control box is not exposed to direct solar radiation. Exposure to direct solar radiation could affect the temperature switch controlling cooler heaters.

Table 33 — Temperature Limits for Standard Units

TEMPERATURE	F	C
Maximum Ambient Temperature	125	52
Minimum Ambient Temperature	0	-18
Maximum Cooler EWT*	95	35
Maximum Cooler LWT	70	21
Minimum Cooler LWT†	38	3.3

LEGEND

EWT — Entering Fluid (Water) Temperature
LWT — Leaving Fluid (Water) Temperature

*For sustained operation, EWT should not exceed 85 F (29.4 C).

†Unit requires modification below this temperature.

Low-Ambient Operation — If operating temperatures below 0° F (-18 C) are expected, refer to separate installation instructions for low-ambient operation using accessory Motormaster® III control. Contact your Carrier representative for details.

NOTE: Wind baffles and brackets must be field-fabricated for all units using accessory Motormaster III controls to ensure proper cooling cycle operation at low-ambient temperatures. See Installation Instructions shipped with the Motormaster III accessory for more details.

CAUTION

Brine duty application (below 38 F [3.3 C] LCWT) for chiller normally requires factory modification. Contact your Carrier representative for applicable LCWT range for standard water-cooled chiller in a specific application.

VOLTAGE

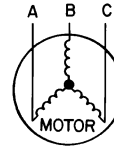
Main Power Supply — Minimum and maximum acceptable supply voltages are listed in the Installation Instructions.

Unbalanced 3-Phase Supply Voltage — *Never operate a motor where a phase imbalance between phases is greater than 2%. To determine percent voltage imbalance:*

$$\% \text{ Voltage Imbalance} = 100 \times \frac{\text{max voltage deviation from avg voltage}}{\text{average voltage}}$$

The maximum voltage deviation is the largest difference between a voltage measurement across 2 legs and the average across all 3 legs.

Example: Supply voltage is 240-3-60.



AB = 243 v
BC = 236 v
AC = 238 v

1. Determine average voltage:

$$\begin{aligned} \text{Average voltage} &= \frac{243 + 236 + 238}{3} \\ &= \frac{717}{3} \\ &= 239 \text{ v} \end{aligned}$$

2. Determine maximum deviation from average voltage:

(AB) 243 - 239 = 4 v
(BC) 239 - 236 = 3 v
(AC) 239 - 238 = 1 v
Maximum deviation is 4 v.

3. Determine percent voltage imbalance:

$$\begin{aligned} \% \text{ Voltage Imbalance} &= 100 \times \frac{4}{239} \\ &= 1.7\% \end{aligned}$$

This voltage imbalance is satisfactory as it is below the maximum allowable of 2%.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately. Do not operate unit until imbalance condition is corrected.

Control Circuit Power — Electronic control includes logic to detect low control circuit voltage. Acceptable voltage ranges are shown in the Installation Instructions.

MINIMUM FLUID LOOP VOLUME — To obtain proper temperature control, loop fluid volume must be at least 3 gallons per ton (3.25 L per kW) of chiller nominal capacity for air conditioning and at least 6 gallons per ton (6.5 L per kW) for process applications or systems that must operate at low ambient temperatures (below 32 F [0° C]). Refer to application information in Product Data literature for details.

FLOW RATE REQUIREMENTS — Standard chillers should be applied with nominal flow rates approximating those listed in Table 34. Higher or lower flow rates are permissible to obtain lower or higher temperature rises. Minimum flow rates *must be exceeded* to assure turbulent flow and proper heat transfer in the cooler.

CAUTION

Operation below minimum flow rate could subject tubes to frost pinching in tube sheet, resulting in failure of cooler.

Consult application data section in the Product Data literature and job design requirements to determine flow rate requirements for a particular installation.

Table 34 — Nominal and Minimum Cooler Fluid Flow Rates

30GTN,R UNIT SIZE	NOMINAL FLOW RATE*		MINIMUM FLOW RATE (See Notes)	
	Gpm	L/s	Gpm	L/s
040	86	5.43	36.8	2.32
045	101	6.37	37.7	2.38
050	123	7.76	37.7	2.38
060	151	9.53	47.5	3.00
070	173	10.91	47.5	3.00
080,230B	192	12.11	66.7	4.20
090,245B	216	13.62	59.5	3.75
100,255B,270B	240	15.14	84.1	5.30
110,290B,315B	264	16.65	84.1	5.30
130	300	18.9	110	6.9
150,230A-255A	348	21.9	110	6.9
170,270A,330A/B, 360B (50 Hz)	384	24.2	120	7.5
190,290A,360A/B (60 Hz), 360A (50 Hz),390B	432	27.2	120	7.5
210,315A,390A,420A/B	480	30.2	148	9.3

LEGEND

ARI — Air Conditioning and Refrigeration Institute
Gpm — Gallons per minute (U.S.)
L/s — Liters per second
N — Liters per kW
V — Gallons per ton

*Nominal flow rates required at ARI conditions are 44 F (6.7 C) leaving-fluid temperature, 54 F (12.2 C) entering-fluid temperature, 95 F (35 C) ambient. Fouling factor is .00001 ft² · hr · F/Btu (.000018 m² · K/W).

NOTES:

1. Minimum flow based on 1.0 fps (0.30 m/s) velocity in cooler without special cooler baffling.
2. Minimum Loop Volumes:
Gallons = V x ARI Cap. in tons
Liters = N x ARI Cap. in kW

APPLICATION	V	N
Normal Air Conditioning	3	3.25
Process Type Cooling	6 to 10	6.5 to 10.8
Low Ambient Unit Operation	6 to 10	6.5 to 10.8

Operation Sequence — During unit off cycle, crank-case heaters are energized. If ambient temperature is below 36 F (2 C), cooler heaters (if equipped) are energized.

The unit is started by putting the ENABLE/OFF/REMOTE CONTACT switch in ENABLE or REMOTE position. When the unit receives a call for cooling (either from the internal

control or CCN network command or remote contact closure), the unit stages up in capacity to maintain the cooler fluid set point. The first compressor starts 1½ to 3 minutes after the call for cooling.

The lead circuit can be specifically designated or randomly selected by the controls, depending on how the unit is field configured (for 040-070 sizes, Circuit A leads unless an accessory unloader is installed on Circuit B). A field configuration is also available to determine if the unit should stage up both circuits equally or load one circuit completely before bringing on the other.

When the lead circuit compressor starts, the unit starts with a pumpout routine. On units with the electronic expansion valve (EXV), compressor starts and continues to run with the EXV at minimum position for 10 seconds to purge the refrigerant lines and cooler of refrigerant. The EXV then moves to 23% and the compressor superheat control routine takes over, modulating the valve to feed refrigerant into the cooler.

On units with thermostatic expansion valve (TXV) (30GTN,R040,045 units with brine option), head pressure control is based on set point control. When the lead compressor starts, the liquid line solenoid valve (LLSV) is kept closed for 15 seconds by a time delay relay. The micro-processor stages fans to maintain the set point temperature specified by the controller. There is no pumpout sequence during shutdown of TXV controlled chillers.

On all other units (EXV units), the head pressure is controlled by fan cycling. The desired head pressure set point is entered, and is controlled by EXV position or saturated condensing temperature measurement (T3 and T4). For proper operation, maintain set point of 113 F (45 C) as shipped from factory. The default head pressure control method is set point control. The head pressure control can also be set to EXV control or a combination of the 2 methods between circuits.

For all units, if temperature reset is being used, the unit controls to a higher leaving-fluid temperature as the building load reduces. If demand limit is used, the unit may temporarily be unable to maintain the desired leaving-fluid temperature because of imposed power limitations.

On EXV units, when the occupied period ends, or when the building load drops low enough, the lag compressors shut down. The lead compressors continue to run as the EXV closes, and until the conditions of pumpout are satisfied. If a fault condition is signaled requiring immediate shutdown, pumpout is omitted.

Loading sequence for compressors is shown in Tables 5A and 5B.

APPENDIX A — CCN TABLES

UNIT (Configuration Settings)

	DESCRIPTION	STATUS	DEFAULT	UNITS	POINT
1	Unit Type	1 = Air Cooled 2 = Water Cooled 3 = Split System 4 = Heat Machine 5 = Air Cooled Heat Reclaim	1		UNIT__TYP
2	Unit Size	15 to 300	20	TONS	SIZE
3	Circuit A1% Capacity	0 to 100	50	%	CAP__A
4	Number Circ A Compressor	1 to 4	1		NUMCA
5	Compressor A1 Cylinders	4 or 6	6		NUM__CYLA
6	Number Circ B Compressor	1 to 4	1		NUMCB
7	Compressor B1 Cylinders	4 or 6	6		NUM__CYLB
8	EXV Module Installed	No/Yes	Yes		EXV__BRD
9	EXV Superheat Setpoint	10 to 40	29.0	^F	SH__SP
10	EXV MOP	40 to 80	50.0	^F	MOP__SP
11	EXV Superheat Offset	- 20 to 20	0.0	^F	SH__OFFST
12	EXV Circ. A Min Position	0 to 100	8.0	%	EXVAMINP
13	EXV Circ. B Min Position	0 to 100	8.0	%	EXVBMINP
14	Refrigerant	1 = R22 2 = R134A	1		REFRIG__T
15	Low Pressure Setpoint	3 to 60	10.0	PSI	LOW__PRES
16	Fan Staging Select	1 = 2 Stage indpt. 2 = 3 Stage indpt. 3 = 2 Stage common 4 = 3 Stage common	1		FAN__TYPE

OPTIONS1 (Options Configuration)

	DESCRIPTION	STATUS	DEFAULT	POINT
1	Cooler Fluid	1 = Water 2 = Med. Brine 3 = Low Brine	1	FLUIDTYP
2	Hot Gas Bypass Select	No/Yes	No	HGBV__FLG
3	Head Press. Cont. Method	1 = EXV controlled 2 = Setpoint controlled 3 = Setpoint-A, EXV-B 4 = EXV-A, Setpoint-B	2	HEAD__MET
4	Head Press. Control Type	0 = None 1 = Air Cooled 2 = Water Cooled	0	HEAD__TYP
5	Pressure Transducers	No/Yes	No	PRESS__TY
6	Cooler Pump Interlock	Off/On	On	LOCK__FLG
7	Cooler Pump Control	Off/On	Off	CPC
8	No. Circuit A Unloaders	0-2	1	NUNLA
9	No. Circuit B Unloaders	0-2	1	NUNLB
10	EMM Module Installed	No/Yes	No	EMM__BRD

CONFIGURATION SCREEN (TYPE 10)**OPTIONS2 (Options Configuration)**

	DESCRIPTION	STATUS	DEFAULT	UNITS	POINT
1	Control Method	0 = Switch 1 = 7 day sched. 2 = Occupancy 3 = CCN	0		CONTROL
2	Loading Sequence Select	1 = Equal loading 2 = Staged loading	1		SEQ__TYPE
3	Lead/Lag Sequence Select	1 = Automatic 2 = Circuit A leads 3 = Circuit B leads	1		LEAD__TYP
4	Cooling Setpoint Select	0 = Single 1 = Dual, remote switch controlled 2 = Dual, clock controlled 3 = 4-20 ma input	0		CLSP__TYP
5	Ramp Load Select	ON/OFF	OFF		RAMP__EBL
6	High LCW Alert Limit	2 to 60	60.0	^F	LCW__LMT
7	Minutes off time	0 to 15	0	min	DELAY
8	Deadband Multiplier	1.0 to 4.0	1.0		Z__GAIN

DISPLAY (STDU SETUP)

	DESCRIPTION	STATUS	DEFAULT	UNITS	POINT
1	STDU Password	nnnn	1111		PASSWORD
2	Password Enable	enable/disable	enable		PASS__EBL
3	Metric Display	Off/On	Off		DISPUNIT
4	Language	0 = ENGLISH 1 = FRANCAIS 2 = ESPANOL 3 = PORTUGUES	0		LANGUAGE

CONFIG (TIMED OVERRIDE SETUP)

	DESCRIPTION	STATUS	DEFAULT	UNITS	POINT
1	Schedule Number	0-99	0		SCHEDNUM
2	Override Time Limit	0-4	0	hours	OTL
3	Timed Override Hours	0-4	0	hours	OTL__EXT

ALARMDEF (Alarm Definition Table)

	DESCRIPTION	STATUS	DEFAULT	UNITS	POINT
1	Alarm Routing Control ALRM_CNT	00000000	00000000		
2	Equipment Priority EQP__TYPE	0 to 7	4		
3	Comm Failure Retry Time	1 to 240	10	min	RETRY_TM
4	Re-alarm Time	1 to 255	30	min	RE-ALARM
5	Alarm System Name	XXXXXXXX	30_PIC		ALRM_NAM

RESETCON (Temperature Reset and Demand Limit)

	DESCRIPTION	STATUS	DEFAULT	UNITS	POINT
1	COOLING RESET				
2	Cooling Reset Type	0 = No Reset 1 = 4-20 ma input 2 = External temp-OAT 3 = Return fluid 4 = External temp-SPT	0		CRST__TYP
3	No Cool Reset Temp	0 to 125	0.0	°F	CT__NO
4	Full Cool Reset Temp	0 to 125	125.0	°F	CT__FULL
5	Degrees Cool Reset	-30 to 30	0.0	^F	CT__DEG
6	DEMAND LIMIT				
7	Demand Limit Select	0 = None 1 = External switch input 2 = 4-20 ma input 3 = Loadshed	0		DMD__CTRL
8	Demand Limit at 20mA	0 to 100	100	%	DMT20MA
9	Loadshed Group Number	0 to 99	0		SHED__NUM
10	Loadshed Demand Delta	0 to 60	0	%	SHED__DEL
11	Maximum Loadshed Time	0 to 120	60	min	SHED__TIM
12	Demand Limit Switch 1	0 to 100	80	%	DLSWSP1
13	Demand Limit Switch 2	0 to 100	50	%	DLSWSP2
14	LEAD/LAG				
15	Lead/Lag Enable	Enable/Disable	Disable		LL__ENA
16	Master/Slave Select	Slave/Master	Master		MS__SEL
17	Slave Address	0 to 239	0		SLV__ADDR
18	Lead/Lag Balance Select	Enable/Disable	Disable		LL__BAL
19	Lead/Lag Balance Delta	40 to 400	168	hours	LL__BAL__D
20	Lag Start Delay	0 to 30	5	mins	LL__DELAY

BRODEFS (Broadcast POC Definition Table)

	DESCRIPTION	STATUS	DEFAULT	UNITS	POINT
1	CCN Time/Date Broadcast	Yes/No	No		CCNBC
2	CCN OAT Broadcast	Yes/No	No		OATBC
3	Global Schedule Broadcast	Yes/No	No		GSBC
4	CCN Broadcast Acker	Yes/No	No		CCNBCACK
5	Daylight Savings Start				
6	Month	1 to 12	1		STARTM
7	Week	1 to 5	1		STARTW
8	Day	1 to 7	0		STARTD
9	Minutes to add	0 to 99	0	min	MINADD
10	Daylight Savings Stop				
11	Month	1 to 12	1		STOPM
12	Week	1 to 5	1		STOPW
13	Day	1 to 7	0		STOPD
14	Minutes to subtract	0 to 99	0	min	MINSUB

GENUNIT (General Unit Parameters)

	DESCRIPTION	STATUS	UNITS	POINT	FORCEABLE
1	Control Mode	0 = Service Test 1 = OFF - local control 2 = OFF-CCN control 3 = OFF-timeclock 4 = Emergency stop 5 = ON-local control 6 = ON-CCN control 7 = ON-timeclock		MODE	N
2	Occupied	Yes/No		OCC	N
3	CCN Chiller	Start/Stop		CHIL__S__S	Y
4	Alarm State	Normal		ALM	N
5	Active Demand Limit	0-100	%	DEM__LIM	Y
6	Percent Total Capacity	0-100	%	CAP__T	N
7	Requested Stage	nn		STAGE	N
8	Load/Unload Factor	snnn.n		SMZ	N
9	Active Setpoint	snnn.n	°F	SP	N
10	Control Point	snnn.n	°F	CTRL__PNT	Y
11	Entering Fluid Temp	snnn.n	°F	EWT	N
12	Leaving Fluid Temp	snnn.n	°F	LWT	N
13	Emergency Stop	Enable/Emstop		EMSTOP	Y
14	Minutes Left for Start	nn	min	MIN__LEFT	N

CIRCA__AN (Circuit A Analog values)

	DESCRIPTION	STATUS	UNITS	POINT	FORCEABLE
1	Circuit A Analog Values				
2	Percent Total Capacity	0-100	%	CAPA__T	N
3	Percent Available Cap	0-100	%	CAPA__A	N
4	Discharge Pressure	nnn.n	PSI	DP__A	N
5	Suction Pressure	nnn.n	PSI	SP__A	N
6	Saturated Condensing Tmp	snnn.n	°F	TMP__SCTA	N
7	Saturated Suction Temp	snnn.n	°F	TMP__SSTA	N
8	Compressor Suction Temp	snnn.n	°F	CTA__TMP	N
9	Suction Superheat Temp	snnn.n	°F	SH__A	N
10	EXV % Open	0-100.0	%	EXV__A	N

CIRCA__DO (Circuit A Discrete Parameters)

	DESCRIPTION	STATUS	UNITS	POINT	FORCEABLE
1	Circuit A Discretes				
2	Fan A1 Relay	ON/OFF		FAN__A1	N
3	Fan A2 Relay	ON/OFF		FAN__A2	N
4	Oil Pressure Switch	OPEN/CLOSE		OILSW__A	N
5	Compressor A1 Relay	ON/OFF		K__A1__RLY	N
6	Compressor A2 Relay	ON/OFF		K__A2__RLY	N
7	Compressor A3 Relay	ON/OFF		K__A3__RLY	N
8	Compressor A4 Relay	ON/OFF		K__A4__RLY	N
9	Unloader A1 Relay	ON/OFF		UNL__A1	N
10	Unloader A2 Relay	ON/OFF		UNL__A2	N
11	Hot Gas Bypass Relay	ON/OFF		HGAS	N

CIRCB__AN (Circuit B Analog Parameters)

	DESCRIPTION	STATUS	UNITS	POINT	FORCEABLE
1	Circuit B Analog Values				
2	Percent Total Capacity	0-100	%	CAPB__T	N
3	Percent Available Cap	0-100	%	CAPB__A	N
4	Discharge Pressure	nnn.n	PSI	DP__B	N
5	Suction Pressure	nnn.n	PSI	SP__B	N
6	Saturated Condensing Tmp	snnn.n	°F	TMP__SCTB	N
7	Saturated Suction Temp	snnn.n	°F	TMP__SSTB	N
8	Compressor Suction Temp	snnn.n	°F	CTB__TMP	N
9	Suction Superheat Temp	snnn.n	°F	SH__B	N
10	EXV % Open	0-100.0	%	EXV__B	N

CIRCB__DO (Circuit B Discrete Parameters)

	DESCRIPTION	STATUS	UNITS	POINT	FORCEABLE
1	Circuit B Discretes				
2	Fan B1 Relay	ON/OFF		FAN__B1	N
3	Fan B2 Relay	ON/OFF		FAN__B2	N
4	Oil Pressure Switch	OPEN/CLOSE		OILSW__B	N
5	Compressor B1 Relay	ON/OFF		K__B1__RLY	N
6	Compressor B2 Relay	ON/OFF		K__B2__RLY	N
7	Compressor B3 Relay	ON/OFF		K__B3__RLY	N
8	Compressor B4 Relay	ON/OFF		K__B4__RLY	N
9	Unloader B1 Relay	ON/OFF		UNL__B1	N
10	Unloader B2 Relay	ON/OFF		UNL__B2	N
11	Hot Gas Bypass Relay	ON/OFF		HGAS	N

OPTIONS (Unit Parameters)

	DESCRIPTION	STATUS	UNITS	POINT	FORCEABLE
1	UNIT Analog Values				
2	Cooler Entering Fluid	snnn.n	°F	COOL__EWT	N
3	Cooler Leaving Fluid	snnn.n	°F	COOL__LWT	N
4	Temperature Reset				
5	4-20 MA Reset Signal	nn.n	ma	RST__MA	N
6	Outside Air Temperature	snnn.n	°F	OAT	Y
7	Space Temperature	snn.n	°F	SPT	Y
8	Demand Limit				
9	4-20 MA Demand Signal	nn.n	ma	LMT__MA	N
10	Demand Limit Switch 1	ON/OFF		DMD__SW1	N
11	Demand Limit Switch 2	ON/OFF		DMD__SW2	N
12	CCN Loadshed Signal	Normal/Redline/Shed		DL__STAT	N
13	Pumps				
14	Cooler Pump Relay	ON/OFF		COOL__PMP	N
15	Miscellaneous				
16	Dual Setpoint Switch	ON/OFF		DUAL__IN	N
17	Cooler Flow Switch	ON/OFF		COOLFLOW	N
18	Ice Done	ON/OFF		ICE	N

STRTHOUR

	DESCRIPTION	STATUS	UNITS	POINT
1	Machine Operating Hours	nnnnn	hours	HR_MACH
2	Machine Starts	nnnnn		CY_MACH
3				
4	Circuit A Run Hours	nnnnn	hours	HR_CIRA
5	Compressor A1 Hours	nnnnn	hours	HR_A1
6	Compressor A2 Hours	nnnnn	hours	HR_A2
7	Compressor A3 Hours	nnnnn	hours	HR_A3
8	Compressor A4 Hours	nnnnn	hours	HR_A4
9	Circuit B Run Hours	nnnnn	hours	HR_CIRB
10	Compressor B1 Hours	nnnnn	hours	HR_B1
11	Compressor B2 Hours	nnnnn	hours	HR_B2
12	Compressor B3 Hours	nnnnn	hours	HR_B3
13	Compressor B4 Hours	nnnnn	hours	HR_B4
14				
15	Circuit A Starts	nnnnn		CY_CIRA
16	Compressor A1 Starts	nnnnn		CY_A1
17	Compressor A2 Starts	nnnnn		CY_A2
18	Compressor A3 Starts	nnnnn		CY_A3
19	Compressor A4 Starts	nnnnn		CY_A4
20	Circuit B Starts	nnnnn		CY_CIRB
21	Compressor B1 Starts	nnnnn		CY_B1
22	Compressor B2 Starts	nnnnn		CY_B2
23	Compressor B3 Starts	nnnnn		CY_B3
24	Compressor B4 Starts	nnnnn		CY_B4

ALARMS

	DESCRIPTION	STATUS	UNITS	POINT
1	Active Alarm #1	Axxx		ALARM01C
2	Active Alarm #2	Axxx		ALARM02C
3	Active Alarm #3	Axxx		ALARM03C
4	Active Alarm #4	Axxx		ALARM04C
5	Active Alarm #5	Axxx		ALARM05C
6	Active Alarm #6	Axxx		ALARM06C
7	Active Alarm #7	Axxx		ALARM07C
8	Active Alarm #8	Axxx		ALARM08C
9	Active Alarm #9	Axxx		ALARM09C
10	Active Alarm #10	Axxx		ALARM10C
11	Active Alarm #11	Axxx		ALARM11C
12	Active Alarm #12	Axxx		ALARM12C
13	Active Alarm #13	Axxx		ALARM13C
14	Active Alarm #14	Axxx		ALARM14C
15	Active Alarm #15	Axxx		ALARM15C
16	Active Alarm #16	Axxx		ALARM16C
17	Active Alarm #17	Axxx		ALARM17C
18	Active Alarm #18	Axxx		ALARM18C
19	Active Alarm #19	Axxx		ALARM19C
20	Active Alarm #20	Axxx		ALARM20C
21	Active Alarm #21	Axxx		ALARM21C
22	Active Alarm #22	Axxx		ALARM22C
23	Active Alarm #23	Axxx		ALARM23C
24	Active Alarm #24	Axxx		ALARM24C
25	Active Alarm #25	Axxx		ALARM25C

NOTE: Alerts will displayed as Txxx

CURRMODS

	DESCRIPTION	STATUS	UNITS	POINT
1	FSM controlling chiller	ON/OFF		MODE__1
2	WSM controlling chiller	ON/OFF		MODE__2
3	Master/Slave control	ON/OFF		MODE__3
4	Low source protection	ON/OFF		MODE__4
5	Ramp Load Limited	ON/OFF		MODE__5
6	Timed Override in effect	ON/OFF		MODE__6
7	Low Cooler Suction TempA	ON/OFF		MODE__7
8	Low Cooler Suction TempB	ON/OFF		MODE__8
9	Slow Change Override	ON/OFF		MODE__9
10	Minimum OFF Time	ON/OFF		MODE__10
11	Low Suction Superheat A	ON/OFF		MODE__11
12	Low Suction Superheat B	ON/OFF		MODE__12
13	Dual Setpoint	ON/OFF		MODE__13
14	Temperature Reset	ON/OFF		MODE__14
15	Demand Limit in effect	ON/OFF		MODE__15
16	Cooler Freeze Prevention	ON/OFF		MODE__16
17	Lo Tmp Cool/Hi Tmp Heat	ON/OFF		MODE__17
18	Hi Tmp Cool/Lo Tmp Heat	ON/OFF		MODE__18

SETPOINT

	DESCRIPTION	STATUS	UNITS	POINT	DEFAULTS
1	COOLING				
2	Cool Setpoint 1	-20 to 70	°F	CSP1	44
3	Cool Setpoint 2	-20 to 70	°F	CSP2	44
4	RAMP LOADING				
5	Cooling Ramp Loading	0.2 to 2.0	°F/min	CRAMP	1.0
6	HEAD PRESSURE				
7	Head Press. Stpt A	80 to 140	°F	HSP__A	113
8	Head Press. Stpt B	80 to 140	°F	HSP__B	113

LID DEFAULT SCREEN DEFINITION

TABLE TYPE 19 HEX

	DESCRIPTION	STATUS	UNITS	POINT	DISPLAY
1	(SYSTEM PRIMARY MESSAGE)				
2	(SYSTEM SECONDARY MESSAGE)				
3	Machine Operating Hours	nnnnn	hours	HR__MACH	HR__MACH
4	Entering Chilled Water	snnn.n	°F	EWT	EWT
5	Leaving Chilled Water	snnn.n	°F	LWT	LWT
6	Control Point	snnn.n	°F	CTRL__PNT	CTRL__PNT
7	Percent Total Capacity	0-100	%	CAP__T	CAP__T
8	Active Demand Limit	0-100	%	DEM_LIM	DEM_LIM
9	Operating Setpoint	snnn.n	°F	SP	SP
10	Circuit A Total Cap	0-100	%	CAPA__T	CAPA__T
11	Circuit B Total Cap	0-100	%	CAPB__T	CAPB__T
12	Machine Starts	nnnnn		CY__MACH	CY__MACH

CSM/FSM EQUIPMENT TABLE (Type 621H, Block 2)

LINE	DESCRIPTION	POINT
1	Chiller Status 0 = Chiller is off 1 = Valid run state in CCN mode 2 = Recycle active 3 = Chiller is in Local Mode 4 = Power Fail Restart in Progress 5 = Shutdown due to fault 6 = Communication Failure	CHILSTAT
2	unused	
3	Percent Total Capacity Running	CAP_T
4	Service Runtime	HR_MACH
5	unused	
6	unused	
7	unused	
8	Power Fail Auto Restart	ASTART
9	Percent Available Capacity On	CAP_A

WSM EQUIPMENT PART COOL SOURCE MAINTENANCE TABLE SUPERVISOR MAINTENANCE TABLE

DESCRIPTION	STATUS	POINT
WSM Active?	Yes	WSMSTAT
Chilled water temp	46.5 °F	CHWTEMP
Equipment status	On	CHLRST
Commanded state	Enable/Disable/None	CHLRENA
CHW setpoint reset value	2.0 ^F	CHWRVAL
Current CHW setpoint	44.0 °F	CHWSTPT

OCCUPANCY MAINTENANCE TABLE OCCUPANCY SUPERVISORY

DESCRIPTION	STATUS	POINT
Current Mode (1=Occup.)	0,1	MODE
Current Occup. Period #	0-8	PER-NO
Timed-Override in Effect	Yes/No	OVERLAST
Time-Override Duration	0-4 hours	OVR_HRS
Current Occupied Time	0:00	STRTTIME
Current Unoccupied Time	0:00	ENDTIME
Next Occupied Day		NXTOCDAY
Next Occupied Time	0:00	NXTOCTIM
Next Unoccupied Day		NXTUNDAY
Next Unoccupied Time	0:00	NXTUNTIM
Previous Unoccupied Day		PRVUNDAY
Previous Unoccupied Time	0:00	PRVUNTIM

START-UP CHECKLIST FOR COMFORTLINK™ CHILLER SYSTEMS
(Remove and use for job file)

A. Preliminary Information

JOB NAME _____

LOCATION _____

INSTALLING CONTRACTOR _____

DISTRIBUTOR _____

START-UP PERFORMED BY _____

EQUIPMENT: Chiller: MODEL # _____ SERIAL # _____

COMPRESSORS:

CIRCUIT A

1) M# _____

S# _____

MTR# _____

2) M# _____

S# _____

MTR# _____

3) M# _____

S# _____

MTR# _____

4) M# _____

S# _____

MTR# _____

CIRCUIT B

1) M# _____

S# _____

MTR# _____

2) M# _____

S# _____

MTR# _____

3) M# _____

S# _____

MTR# _____

COOLER:

MODEL # _____

MANUFACTURED BY _____

SERIAL # _____

DATE _____

TYPE OF EXPANSION VALVES (check one): EXV _____ TXV _____

AIR-HANDLING EQUIPMENT:

MANUFACTURER _____

MODEL # _____ SERIAL # _____

ADDITIONAL AIR-HANDLING UNITS AND ACCESSORIES _____

B. Preliminary Equipment Check (YES or NO)

IS THERE ANY SHIPPING DAMAGE?_____ IF SO, WHERE_____

WILL THIS DAMAGE PREVENT UNIT START-UP?_____

HAVE COMPRESSOR BASE RAIL ISOLATORS ALL BEEN PROPERLY ADJUSTED? _____

CHECK POWER SUPPLY. DOES IT AGREE WITH UNIT? _____

HAS THE CIRCUIT PROTECTION BEEN SIZED AND INSTALLED PROPERLY? (refer to Installation Instructions)_____

ARE THE POWER WIRES TO THE UNIT SIZED AND INSTALLED PROPERLY? (refer to Installation Instructions)_____

HAS THE GROUND WIRE BEEN CONNECTED?_____

ARE ALL TERMINALS TIGHT?_____

CHECK AIR SYSTEMS (YES or NO)

ARE ALL AIR HANDLERS OPERATING? (refer to air-handling equipment Installation and Start-Up Instructions)_____

ARE ALL CHILLED FLUID VALVES OPEN?_____

IS THE FLUID PIPING CONNECTED PROPERLY?_____

HAS ALL AIR BEEN VENTED FROM THE COOLER LOOP?_____

IS THE CHILLED WATER (FLUID) PUMP (CWP) OPERATING?_____

IS THE CWP ROTATION CORRECT?_____

CWP MOTOR AMPERAGE: Rated _____ Actual _____

C. Unit Start-Up (insert check mark as each item is completed)

CHECK THAT THE CHILLER HAS BEEN PROPERLY INTERLOCKED WITH THE AUXILIARY CONTACTS OF THE CHILLED FLUID PUMP STARTER._____

ASSURE THAT THE UNIT IS SUPPLIED WITH CORRECT CONTROL VOLTAGE POWER.
_____ (115 V FOR 208/230, 460, AND 575 V UNITS; 230 V FOR 380 AND 380/415 UNITS)

ASSURE CRANKCASE HEATERS HAVE BEEN ENERGIZED FOR A MINIMUM OF **24 HOURS** PRIOR TO START-UP.

ASSURE COMPRESSOR OIL LEVEL IS CORRECT. _____

ASSURE BOTH LIQUID LINE SERVICE VALVES ARE BACKSEATED. _____

ASSURE **ALL** COMPRESSOR DISCHARGE SERVICE VALVES ARE BACKSEATED. _____

ASSURE **ALL** COMPRESSOR SUCTION SERVICE VALVES ARE BACKSEATED. _____

LOOSEN COMPRESSOR SHIPPING HOLDDOWN BOLTS._____

LEAK CHECK **THOROUGHLY**: CHECK ALL COMPRESSORS, CONDENSER MANIFOLDS AND HEADERS, EXVs, TXVs, SOLENOID VALVES, FILTER DRIERS, FUSIBLE PLUGS, THERMISTORS, AND COOLER HEADS, WITH GE H-10-B ELECTRONIC LEAK DETECTOR. _____

LOCATE, REPAIR, AND REPORT ANY R-22 LEAKS. _____

C. Unit Start-Up (cont)

CHECK VOLTAGE IMBALANCE: AB_____ AC_____ BC_____

AB + AC + BC (divided by 3) = AVERAGE VOLTAGE = _____ V

MAXIMUM DEVIATION FROM AVERAGE VOLTAGE = _____

VOLTAGE IMBALANCE = $\frac{(\text{MAX. DEVIATION})}{\text{AVERAGE VOLTAGE}} \times 100 = \text{_____ \% VOLTAGE IMBALANCE}$

IF OVER 2% VOLTAGE IMBALANCE, DO NOT ATTEMPT TO START CHILLER!
CALL LOCAL POWER COMPANY FOR ASSISTANCE.

ASSURE THAT INCOMING POWER VOLTAGE TO CHILLER MODULES IS WITHIN RATED UNIT VOLTAGE RANGE. _____

SYSTEM FLUID VOLUME IN LOOP: TYPE SYSTEM:

AIR CONDITIONING — MINIMUM 3 GAL PER NOMINAL TON (3.25 L PER kW) = _____ GAL (L)

PROCESS COOLING — MINIMUM 6 GAL PER NOMINAL TON (6.50 L PER kW) = _____ GAL (L)

CHECK PRESSURE DROP ACROSS COOLER.

FLUID ENTERING COOLER: _____ PSIG (kPa)

FLUID LEAVING COOLER: _____ PSIG (kPa)

(PSIG DIFFERENCE) x 2.31 = FT OF FLUID PRESSURE DROP = _____

PLOT COOLER PRESSURE DROP ON PERFORMANCE DATA CHART (LOCATED IN PRODUCT DATA LITERATURE) TO DETERMINE TOTAL GPM (L/s).

TOTAL GPM (L/s) = _____ UNIT'S RATED MIN GPM (L/s) = _____

GPM (L/s) PER TON = _____ UNIT'S RATED MIN PRESSURE DROP = _____
(Refer to product data literature.)

JOB'S SPECIFIED GPM (L/s) (if available): _____

NOTE: IF UNIT HAS LOW FLUID FLOW, FIND SOURCE OF PROBLEM: CHECK FLUID PIPING, IN-LINE FLUID STRAINER, SHUT-OFF VALVES, CWP ROTATION, ETC.

COOLER LOOP PROTECTION IF REQUIRED:

GALLONS (LITERS) OF BRINE ADDED: _____

PIPING INCLUDES ELECTRIC TAPE HEATERS (Y/N): _____

VISUALLY CHECK MAIN BASE BOARD AND EXV BOARD FOR THE FOLLOWING:

INSPECT ALL THERMISTORS AND EXV CABLES FOR POSSIBLE CROSSED WIRES. _____

CHECK TO BE SURE ALL WELL-TYPE THERMISTORS ARE FULLY INSERTED INTO THEIR RESPECTIVE WELLS. _____

ARE ALL CABLES AND PIN CONNECTORS TIGHT? (Y/N) _____

ARE EXV, EMM, AND CXB BOARDS (IF INSTALLED) AND DISPLAY CONNECTIONS TIGHT? _____

C. Unit Start-Up (cont)

TO START THE CHILLER: (insert check mark as each item is completed)

TURN THE EMERGENCY ON/OFF SWITCH (SW2) TO ON POSITION.

LEAVE THE ENABLE/OFF/REMOTE CONTACT SWITCH (SW1) IN THE OFF POSITION.

NOTE: USE ESCAPE KEY TO GO UP ONE LEVEL IN THE STRUCTURE.

USE ARROW/ESCAPE KEYS TO ILLUMINATE CONFIGURATION LED. PRESS ENTER KEY AND 'DISP' WILL BE DISPLAYED. PRESS DOWN ARROW KEY TO DISPLAY 'UNIT'. PRESS ENTER KEY. RECORD CONFIGURATION INFORMATION BELOW:

UNIT (Configuration Settings)

DESCRIPTION	STATUS	DEFAULT	UNITS	VALUE
Unit Type	1 = Air Cooled 2 = Water Cooled 3 = Split System 4 = Heat Machine 5 = Air Cooled Heat Reclaim	1		
Unit Size	15 to 300	20	TONS	
Circuit A1% Capacity	0 to 100	50	%	
Number Circ A Compressor	1 to 4	1		
Compressor A1 Cylinders	4 or 6	6		
Number Circ B Compressor	1 to 4	1		
Compressor B1 Cylinders	4 or 6	6		
EXV Module Installed	No/Yes	Yes		
EXV Superheat Setpoint	10 to 40	29.0	^F	
EXV Superheat Offset	- 20 to 20	0.0	^F	
EXV Circ. A Min Position	0 to 100	8.0	%	
EXV Circ. B Min Position	0 to 100	8.0	%	
Refrigerant	1 = R22 2 = R134A	1		
Fan Staging Select	1 = 2 Stage indpt. 2 = 3 Stage indpt. 3 = 2 Stage common 4 = 3 Stage common	1		

PRESS ESCAPE KEY TO DISPLAY 'UNIT'. PRESS DOWN ARROW KEY TO DISPLAY 'OPT1'.

PRESS ENTER KEY. RECORD CONFIGURATION INFORMATION BELOW:

OPTIONS1 (Options Configuration)

DESCRIPTION	STATUS	DEFAULT	VALUE
Cooler Fluid	1 = Water 2 = Med. Brine 3 = Low Brine	1	
Hot Gas Bypass Select	No/Yes	No	
Head Press. Cont. Method	1 = EXV controlled 2 = Setpoint controlled 3 = Setpoint-A, EXV-B 4 = EXV-A, Setpoint-B	2	
Head Press. Control Type	0 = None 1 = Air Cooled 2 = Water Cooled	0	
Pressure Transducers	No/Yes	No	
Cooler Pump Interlock	Off/On	On	
Cooler Pump Control	Off/On	Off	
No. Circuit A Unloaders	0-2	1	
No. Circuit B Unloaders	0-2	1	
EMM Module Installed	No/Yes	No	

C. Unit Start-Up (cont)

PRESS ESCAPE KEY TO DISPLAY 'OPT1'. PRESS DOWN ARROW KEY TO DISPLAY 'OPT2'. PRESS ENTER KEY. RECORD CONFIGURATION INFORMATION BELOW.

OPTIONS2 (Options Configuration)

DESCRIPTION	STATUS	DEFAULT	UNITS	VALUE
Control Method	0 = Switch 1 = 7 day sched. 2 = Occupancy 3 = CCN	0		
CCN Address	1 to 239	1		
CCN Bus Number	0 to 239	0		
CCN Baud Rate	1 = 2400 2 = 4800 3 = 9600 4 = 19,200 5 = 38,400	3		
Loading Sequence Select	1 = Equal loading 2 = Staged loading	1		
Lead/Lag Sequence Select	1 = Automatic 2 = Circuit A leads 3 = Circuit B leads	1		
High LCW Alert Limit	2 to 60	60.0	^F	
Minutes off time	0 to 15	0	min	

PRESS ESCAPE KEY TO DISPLAY 'OPT2'. PRESS DOWN ARROW KEY TO DISPLAY 'RSET'. PRESS ENTER KEY. RECORD CONFIGURATION INFORMATION BELOW:

RESETCON (Temperature Reset and Demand Limit)

DESCRIPTION	STATUS	DEFAULT	UNITS	VALUE
COOLING RESET				
Cooling Reset Type	0 = No Reset 1 = 4-20 ma input 2 = External temp-OAT 3 = Return fluid 4 = External temp-SPT	0		
No Cool Reset Temp	0 to 125	0.0	°F	
Full Cool Reset Temp	0 to 125	125.0	°F	
Degrees Cool Reset	-30 to 30	0.0	^F	
DEMAND LIMIT				
Demand Limit Select	0 = None 1 = External switch input 2 = 4-20 ma input 3 = Loadshed	0		
Demand Limit at 20mA	0 to 100	100	%	
Loadshed Group Number	0 to 99	0		
Loadshed Demand Delta	0 to 60	0	%	
Maximum Loadshed Time	0 to 120	60	min	
Demand Limit Switch 1	0 to 100	80	%	
Demand Limit Switch 2	0 to 100	50	%	
LEAD/LAG				
Lead/Lag Enable	Enable/Disable	Disable		
Master/Slave Select	Slave/Master	Master		
Slave Address	0 to 239	0		
Lead/Lag Balance Select	Enable/Disable	Disable		
Lead/Lag Balance Delta	40 to 400	168	hours	
Lag Start Delay	0 to 30	5	mins	

C. Unit Start-Up (cont)

PRESS ESCAPE KEY TO DISPLAY 'RSET'. PRESS DOWN ARROW KEY TO DISPLAY 'SLCT'. PRESS ENTER KEY. RECORD CONFIGURATION INFORMATION BELOW:

SLCT (Cooling Setpoint Select)

DESCRIPTION	STATUS	DEFAULT	UNITS	VALUE
Cooling Setpoint Select	0 = Single 1 = Dual Switch 2 = Dual Clock 3 = 4 to 20 mA Input	0		
Ramp Load Select	Enable/Disable	Enable		
Cooling Ramp Loading	0.2 to 2.0	1.0		
Deadband Multiplier	1.0 to 4.0	1.0		

PRESS ESCAPE KEY SEVERAL TIMES TO GET TO THE MODE LEVEL (BLANK DISPLAY). USE THE ARROW KEYS TO SCROLL TO THE SET POINT LED. PRESS ENTER TO DISPLAY SETPOINTS. RECORD CONFIGURATION INFORMATION BELOW:

SETPOINT

DESCRIPTION	STATUS	UNITS	DEFAULTS	VALUE
COOLING				
Cool Setpoint 1	-20 to 70	°F	44	
Cool Setpoint 2	-20 to 70	°F	44	
RAMP LOADING				
Cooling Ramp Loading	0.2 to 2.0	°F/min	1.0	
HEAD PRESSURE				
Head Press. Stpt A	80 to 140	°F	113	
Head Press. Stpt B	80 to 140	°F	113	

USE ARROW/ESCAPE KEYS TO ILLUMINATE TEMPERATURES LED. PRESS ENTER TO DISPLAY 'UNIT'. PRESS ENTER AND USE THE ARROW KEYS TO RECORD TEMPERATURES FOR T1 AND T2 BELOW. RECORD T9 AND T10 IF INSTALLED. PRESS ESCAPE TO DISPLAY 'UNIT' AGAIN AND PRESS THE DOWN ARROW KEY TO DISPLAY 'CIR.A'. PRESS ENTER AND USE THE ARROW KEYS TO RECORD TEMPERATURES FOR T3, T5 AND T7 BELOW. PRESS ESCAPE TO DISPLAY 'CIR.A' AGAIN AND PRESS THE DOWN ARROW KEY TO DISPLAY 'CIR.B'. PRESS ENTER AND USE THE DOWN ARROW KEYS TO RECORD TEMPERATURES FOR T4, T6 AND T8 BELOW. USING A DC VOLTMETER, MEASURE AND RECORD THE VOLTAGE FOR EACH THERMISTOR AT THE LOCATION SHOWN.

	TEMPERATURE	VDC	BOARD LOCATION
T1 (CLWT)	_____	_____	MBB, J8 PINS 13,14
T2 (CEWT)	_____	_____	MBB, J8 PINS 11,12
T3 (SCT.A)	_____	_____	MBB, J8 PINS 21,22
T4 (SCT.B)	_____	_____	MBB, J8 PINS 15,16
T5 (SST.A)	_____	_____	MBB, J8 PINS 24,25 (EXV UNITS ONLY)
T6 (SST.B)	_____	_____	MBB, J8 PINS 18,19 (EXV UNITS ONLY)
T7 (SGT.A)	_____	_____	EXV, J5 PINS 11,12 (EXV UNITS ONLY)
T8 (SGT.B)	_____	_____	EXV, J5 PINS 9,10 (EXV UNITS ONLY)
T9 (OAT)	_____	_____	MBB, J8 PINS 7,8
T10 (SPT)	_____	_____	MBB, J8 PINS 5,6

C. Unit Start-Up (cont)

USE ESCAPE/ARROW KEYS TO ILLUMINATE CONFIGURATION LED. PRESS ENTER TO DISPLAY 'DISP'. PRESS ENTER AGAIN TO DISPLAY 'TEST' FOLLOWED BY 'OFF'. PRESS ENTER TO STOP DISPLAY AT 'OFF' AND ENTER AGAIN SO 'OFF' DISPLAY FLASHES. 'PASS' AND 'WORD' WILL FLASH IF PASSWORD NEEDS TO BE ENTERED. PRESS ENTER TO DISPLAY PASSWORD FIELD AND USE THE ENTER KEY FOR EACH OF THE FOUR PASSWORD DIGITS. USE ARROW KEYS IF PASSWORD IS OTHER THAN STANDARD. AT FLASHING 'OFF' DISPLAY, PRESS THE UP ARROW KEY TO DISPLAY 'ON' AND PRESS ENTER. ALL LED SEGMENTS AND MODE LEDS WILL LIGHT UP. PRESS ESCAPE TO STOP THE TEST. PRESS ESCAPE TO RETURN TO THE 'DISP' DISPLAY. PRESS THE ESCAPE KEY AGAIN AND USE THE ARROW KEYS TO ILLUMINATE THE SERVICE TEST LED. PRESS ENTER TO DISPLAY 'TEST'. PRESS ENTER TO STOP DISPLAY AT 'OFF' AND ENTER AGAIN SO 'OFF' FLASHES. PRESS THE UP ARROW KEY AND ENTER TO ENABLE THE MANUAL MODE. PRESS ESCAPE AND DISPLAY NOW SAYS 'TEST' 'ON'.

PRESS THE DOWN ARROW TO DISPLAY 'OUTS'. PRESS THE ENTER KEY TO DISPLAY 'FR.A1'. PRESS THE ENTER KEY TO STOP DISPLAY AT 'OFF' AND ENTER AGAIN SO 'OFF' FLASHES. PRESS THE UP ARROW KEY AND ENTER TO TURN THE OUTPUT ON. PRESS ENTER SO THE 'ON' DISPLAY FLASHES, PRESS THE DOWN ARROW KEY AND THEN ENTER TO TURN THE OUTPUT OFF. OUTPUTS WILL ALSO BE TURNED OFF OR SENT TO 0% WHEN ANOTHER OUTPUT IS TURNED ON. USE THE ARROW KEYS TO SELECT THE DESIRED PERCENTAGE FOLLOWED BY THE ENTER KEY WHEN TESTING EXPANSION VALVES. CHECK OFF THE FOLLOWING THAT APPLY AFTER BEING TESTED:

FR.A1 _____ (CHECK ROTATION)	FR.A2 _____ (CHECK ROTATION)
EXV.A _____	FR.B1 _____ (CHECK ROTATION)
FR.B2 _____ (CHECK ROTATION)	EXV.B _____
CLR.P _____ (TB5-10,12)	RMT.A _____ TB5-11,12)

USE ESCAPE KEY TO RETURN TO 'OUTS' DISPLAY. PRESS DOWN ARROW TO DISPLAY 'COMP'. PRESS ENTER KEY TO DISPLAY 'CC.A1'. NOTE THAT UNLOADERS AND HOT GAS BYPASS SOLENOIDS CAN BE TESTED WITHOUT TURNING THE COMPRESSOR(S) ON. MAKE SURE ALL SERVICE VALVES ARE OPEN AND COOLER PUMP HAS BEEN TURNED ON BEFORE STARTING COMPRESSORS. CHECK OFF EACH ITEM AFTER SUCCESSFUL TEST: LEAD COMPRESSORS (A1/B1) WILL BE TURNED ON BEFORE ANY LAG COMPRESSORS CAN BE STARTED. THE CONTROL WILL ONLY START ONE COMPRESSOR PER MINUTE. WHEN AT THE DESIRED ITEM, PRESS THE ENTER KEY TWICE TO MAKE THE 'OFF' FLASH. PRESS THE UP ARROW KEY AND ENTER TO TURN THE OUTPUT ON.

CC.A1 _____	CC.A2 _____
CC.A3 _____	CC.A4 _____
UL.A1 _____	UL.A2 _____
HGBP _____ (IF INSTALLED)	
CC.B1 _____	CC.B2 _____
CC.B3 _____	CC.B4 _____ N/A _____
UL.B1 _____	UL.B2 _____

TXV UNITS ONLY: CHECK AND ADJUST SUPERHEAT.

